ISBN 0-7729-1071-5

ACIDIC PRECIPITATION IN ONTARIO STUDY

PRECIPITATION AND AIR CONCENTRATION AND WET AND DRY DEPOSITION FIELDS OF POLLUTANTS IN ONTARIO, 1983

ARB-008-86-AQM

APIOS-001-86

Ontario Ministry of the Environment

Dr. David Balsillie, Director
Air Resources Branch

PRECIPITATION AND AIR CONCENTRATION AND WET AND DRY DEPOSITION FIELDS OF POLLUTANTS IN ONTARIO - 1983

Al J.S. Tang, Walter H. Chan , David H.S. Chung and Maris A. Lusis

Air Resources Branch
Ontario Ministry of the Environment
880 Bay Street, 4th Floor
Toronto, Ontario, Canada
M5S 1Z8

January 1986

APIOS Coordination Office
Ontario Ministry of the Environment
6th Floor, 40 St. Clair Avenue West
Toronto, Ontario, Canada
M4V 1P5

c 1985 Her Majesty The Queen in Right of Ontario

SYNOPSIS

This is one of a series of reports presenting annual precipitation and air concentrations, and wet deposition rates, for acidity, sulfates, nitrates and a number of other ions and trace metals monitored by the APIOS (Acidic Precipitatiion in Ontario Study) cumulative air and precipitation network. Dry deposition rates are also estimated for the sulfur and nitrogen compounds, based on their airborne concentrations and recent estimates of their dry deposition velocities.

The 1983 results show similar features to those noted in earlier reports (Chan et. al., 1983[a], 1984[a] and 1985[a]), with elevated air and precipitation concentrations, and atmospheric deposition, of the sulfur and nitrogen compounds in southern Ontario. As in previous years, the target loading of 20 kg SO_4/ha.y wet deposition is exceeded in all of central and southern Ontario. The atmospheric wet deposition rate of sulfur compounds is typically 2-4 times the dry deposition rate; for nitrates, wet and dry deposition rates are more comparable.

The air and precipitation concentrations which were observed for most of the monitored substances, can be explained in terms of the location of their major emission source areas and their susceptibility to long-range transport processes (i.e., their lifetime in the atmosphere). Thus compounds such as sulfur and nitrogen oxides and lead, which are emitted by industrial processes, power generating stations and the transportation sector, and have relatively long atmospheric lifetimes, are found to have a pronounced north-to-south gradient, with the highest values generally along the Ontario - U.S. border. Some of the soil-related parameters (e.g., Fe, Al, Ca) also show relatively elevated values in the southern portions of the province, where most of the agricultural and urbanized areas are located. Several of the contaminants (e.g., PO_4, Cu, Ni) show little systematic, large-scale variation suggesting that in the province as a whole, their air and precipitation concentrations are mainly dominated by non-anthropogenic factors.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge contributions from the following personnel without whose assistance this work would not have been possible: Messrs. D. Allcock, W. Bardswick, S. Elliott, C. Hutt, D. Orr, W. Smits and J.P. Varto, for their involvement in network operation; Mr. W. Chang for data management; and Mr. F. Tomassini and Dr. B. Loescher, for their coordination of the laboratory efforts. Information on sulfur and nitrogen deposition velocities was provided by Dr. E. Voldner of the Atmospheric Environment Service.

Table of Contents

		Page
List of Tables		i
List of Figures		ii
1.	Introduction	1
2.	Data Preparation	2
	2.1 Cumulative Precipitation Samples	2
	2.2 Cumulative Air Samples	2
3.	Results and Discussion	5
	3.1 Precipitation Samples	5
	3.1.1. Annual Precipitation Depth	5
	3.1.2 Annual Precipitation Concentration and Wet Deposition	5
	3.1.2.1 H_f^+ and H_t^+	5
	3.1.2.1 $SO_4^=$ and $N\text{-}NO_3^-$	5
	3.1.2.3 $N\text{-}NH_4^+$ and N-TKN	6
	3.1.2.4 $P\text{-}PO_4^{3-}$	6
	3.1.2.5 Cu and Ni	6
	3.1.2.6 Fe, Al, Ca^{++}, Mg^{++}, and K^+	7
	3.1.2.7 Pb, Zn, Mn and Cd	7
	3.1.2.8 Na^+ and Cl^-	7
	3.1.3 Seasonal Variation in Precipitation Concentration and Wet Deposition	7
	3.2 Air Samples	8
	3.2.1. Air Concentrations	8
	3.2.1.1. $N\text{-}NO_3^-$, $SO_4^=$, SO_2 and total S	8
	3.2.1.2 Fe, Al, Ca^{++}, Mg^{++} and K^+	8
	3.2.1.3 Cu and Ni	9
	3.2.1.4 V	9
	3.2.1.5 Pb, Zn, Mn and Cd	9
	3.2.1.6 Na^+ and Cl^-	9
	3.2.2 Seasonal Variation in Air Concentrations	10
	3.2.3 Dry Deposition of SO_4, SO_2 and $N\text{-}NO_3$	10
3.3	Comparison of Wet and Dry Deposition	10
	References	11
	Tables	13
	Figures	34

List of Tables

Number		Page
1.	Annual Average Precipitation Concentration in Ontario - 1983.	13
2.	Annual Wet Deposition in Ontario - 1983.	15
3.	Annual Average Air Concentration in Ontario - 1983.	16
4.	Annual Dry Deposition ($g/m^2.y$) of $S\text{-}SO_2$, $S\text{-}SO_4$ and $N\text{-}NO_3$	17
5.	Seasonal Gauge Depth Weighted Mean Precipitation Concentration (mg/l) - Winter 82/83.	18
6.	Seasonal Gauge Depth Weighted Mean Precipitation Concentration (mg/l) - Spring 1983.	20
7.	Seasonal Gauge Depth Weighted Mean Precipitation Concentration (mg/l) Summer 1983.	22
8.	Seasonal Gauge Depth Weighted Mean Precipitation Concentration (mg/l) - Autumn 1983.	24
9.	Seasonal Wet Deposition (mg/m^2) - Winter 82/83	26
10.	Seasonal Wet Deposition (mg/m^2) - Spring 1983.	27
11.	Seasonal Wet Deposition (mg/m^2) - Summer 1983.	28
12.	Seasonal Wet Deposition (mg/m^2) - Autumn 1983.	29
13.	Seasonal Geometric Mean Air Concentration (ug/m^3) - Winter 82/83.	30
14.	Seasonal Goemetric Mean Air Concentration (ug/m^3) - Spring 1983.	31
15.	Seasonal Geometric Mean Air Concentration (ug/m^3) - Summer 1983.	32
16.	Seasonal Geometric Mean Concentration Air (ug/m^3) Autumn 1983.	33

List of Figures

Number		Page
1.	APIOS cumulative deposition network site location map (1983).	34
2.	Annual average dry deposition velocity (cm/sec.) of SO_2.	35
3.	Annual average dry deposition velocity (cm/sec.) of SO_4.	36
4.	Annual average dry deposition velocity (cm/sec.) of HNO_3.	37
5.	Annual climate precipitation gauge depth (10 cm).	38
6a.	Annual average precipitation concentration (ug/l) Of H_f -1983.	39
6b.	Annual wet deposition (mg/m^2) of H_f - 1983.	40
7a.	Annual average precipitation concentration (ug/l) of H_t -1983.	41
7b.	Annual wet deposition (mg/m^2) of H_t - 1983.	42
8a.	Annual average precipitation concentration (mg/l) of SO_4 -1983.	43
8b.	Annual wet deposition (g/m^2) of SO_4 - 1983.	44
9a.	Annual average precipitation concentration (mg/l) of N-NO_3 -1983.	45
9b.	Annual wet deposition (g/m^2) of N-NO_3 - 1983.	46
10a.	Annual average precipitation concentration (mg/l) of N-NH_4 -1983.	47
10b.	Annual wet deposition (g/m^2) of N-NH_4 - 1983.	48
11a.	Annual average precipitation concentration (mg/l) of N-TKN -1983.	49
11b.	Annual wet deposition (g/m^2) of N-TKN - 1983.	50
12a.	Annual average precipitation concentration (ug/l) of P-PO_4 -1983.	51
12b.	Annual wet deposition (mg/m^2) of P-PO_4 - 1983.	52
13a.	Annual average precipitation concentration (ug/l) of Cu -1983.	53
13b.	Annual wet deposition (mg/m^2) of Cu - 1983.	54
14a.	Annual average precipitation concentration (ug/l) of Ni -1983.	55
14b.	Annual wet deposition (mg/m^2) of Ni - 1983.	56
15a.	Annual average precipitation concentration (ug/l) of Fe -1983.	57
15b.	Annual wet deposition (mg/m^2) of Fe - 1983.	58
16a.	Annual average precipitation concentration (ug/l) of Al - 1983.	59
16b.	Annual wet deposition (mg/m^2) of Al - 1983.	60
17a.	Annual average precipitation concentration (mg/l) of Ca - 1983.	61

List of Figures (Cont'd)

17b.	Annual wet deposition (g/m^2) of Ca - 1983.	62
18a.	Annual average precipitation concentration (mg/l) of Mg - 1983.	63
18b.	Annual wet deposition (mg/m^2) of Mg - 1983.	64
19a.	Annual average precipitation concentration (ug/l) of K - 1983.	65
19b.	Annual wet deposition (mg/m^2) of K - 1983.	66
20a.	Annual average precipitation concentration (ug/l) of Pb - 1983.	67
20b.	Annual wet deposition (mg/m^2) of Pb - 1983.	68
21a.	Annual average precipitation concentration (ug/l) of Zn - 1983.	69
21b.	Annual wet deposition (mg/m^2) of Zn - 1983.	70
22a.	Annual average precipitation concentration (ug/l) of Mn - 1983.	71
22b.	Annual wet deposition (mg/m^2) of Mn - 1983.	72
23a.	Annual average precipitation concentration (10^{-2} ug/l) of Cd - 1983.	73
23b.	Annual wet deposition (ug/m^2) of Cd - 1983.	74
24a.	Annual average precipitation concentration (ug/l) of Na - 1983.	75
24b.	Annual wet deposition (mg/m^2) of Na - 1983.	76
25a.	Annual average precipitation concentration (mg/l) of Cl - 1983.	77
25b.	Annual wet deposition (mg/m^2) of Cl - 1983.	78
26.	Annual average air concentration (ug/m^3) of $N\text{-}NO_3$ - 1983.	79
27.	Annual average air concentration (ug/m^3) of SO_4 - 1983.	80
28.	Annual average air concentration (ug/m^3) of SO_2 - 1983.	81
29.	Annual average air concentration (ug/m^3) of total S - 1983.	82
30.	Annual average air concentration (10^{-1} ug/m^3) of Fe - 1983.	83
31.	Annual average air concentration (10^{-1} ug/m^3) of Al - 1983.	84
32.	Annual average air concentration (ug/m^3) of Ca - 1983.	85
33.	Annual average air concentration (10^{-1} ug/m^3) of Mg - 1983.	86
34.	Annual average air concentration (10^{-1} ug/m^3) of K - 1983.	87
35.	Annual average air concentration (ng/m^3) of Cu - 1983.	88
36.	Annual average air concentration (ng/m^3) of Ni - 1983.	89

List of Figures (Cont'd)

37.	Annual average air concentration (ng/m^3) of V - 1983.	90
38.	Annual average air concentration (ng/m^3) of Pb - 1983.	91
39.	Annual average air concentration (ng/m^3) of Zn - 1983.	92
40.	Annual average air concentration (mg/m^3) of Mn - 1983.	93
41.	Annual average air concentration (ng/m^3) of Cd - 1983.	94
42.	Annual average air concentration (10^{-1} ug/m^3) of Na - 1983.	95
43.	Annual average air concentration (ug/m^3) of Cl - 1983.	96
44.	Annual dry deposition (g/m^2) of SO_4 - 1983.	97
45.	Annual dry deposition (g/m^2) of SO_2 - 1983.	98
46.	Annual dry deposition (g/m^2) of $N\text{-}NO_3$ - 1983.	99

1. INTRODUCTION

This is one of a series of reports showing the annual precipitation and air concentration, as well as wet and dry deposition fields of selected pollutants in Ontario. The locations of the Cumulative Deposition Network Sites of the Acidic Precipitation in Ontario Study (APIOS) are given in Figure 1. The reports of the 1980/81 and 1982 results of precipitation concentration and wet deposition fields were published in 1983 and 1984, respectively (Chan et al., 1983[a]; Chan et al., 1984[a]). The 1982 results of air concentration and dry deposition fields have also been reported (Chan et al., 1985[a]).

Descriptions of the APIOS cumulative air and precipitation network siting, instrumentation and analytical methods have been given in another document (Chan et al., 1984[b]). The data listings of the 1983 cumulative air and precipitation samples have been published in other reports (Ontario Ministry of the Environment, 1985[a, b]).

2. DATA PREPARATION

2.1 Cumulative Precipitation Samples

Sangamo samplers were used to collect wet-only samples for chemical analysis. Each site was also equipped with a storage gauge to determine the actual precipitation depth for calculating wet deposition. Whenever storage gauge readings were missing, they were replaced by appropriate values interpolated from data obtained at Environment Canada's climatological stations (Atmospheric Environment Service, 1983).

The annual average concentration is calculated according to:

$$Cav = \sum_i Ci\ Di / \sum_i Di,$$

where Cav = Precipitation depth weighted concentration,
Ci = Concentration of individual cumulative sample,
Di = Precipitation depth determined from storage gauge or climatological data.

Annual deposition is calculated according to:

$$Dep = Cav \times \sum_i Di,$$

where Dep = deposition.

The annual average concentration and deposition are listed in Tables 1 and 2. The results calculated from less than eight (out of the thirteen) sampling periods are underlined but were not used in the calculation of isopleths utilizing the Modified Simple Kriging method (Tang and Chan, 1985).

2.2 Cumulative Air Samples

The reported annual average concentration corresponds to the geometric mean concentration of the sampling period from January 5, 1983 to January 4, 1984. The geometric mean concentration values of the measured pollutants using the available data from each monitoring site are listed in Table 3. The results calculated from less than eight out of thirteen sampling periods are underlined but were not used in the calculation of isopleths. The numbering of the stations is not consecutive since only 23 out of 36 precipitation sampling stations are equiped with air samplers.

Because of the large uncertainty in the deposition velocity values for pollutants other than sulfur dioxide, sulfate and nitric acid, only dry deposition of sulfur and nitrogen were calculated. Results are listed in Table 4. The dry deposition rates were calculated according to:

$$Dep = Cav \times Vd$$

where Dep = dry deposition
Cav = geometric mean air concentration
Vd = deposition velocity

The deposition velocities of the sulfur components were estimated using the method of Masse and Voldner (1983) as recently updated by Voldner et. al. (1985), which is an extension of the method of Sheih et al. (1979). For sulfur dioxide, deposition velocities on an annual basis are similar to those of Sheih et al.. They are considerably lower for sulfate, but in basic agreement with recent work (Weseley and Shannon, 1984). Estimating the dry deposition velocities of nitrates involves an additional complication, since the dry deposition of nitrates consists of both nitric acid vapor and particulate nitrates, which are expected to have quite different deposition rates. A detailed study has not yet been undertaken into the proportion of nitrates in the particulate and vapor forms in Ontario. However, the results from the daily filter pack measurements indicate that except for southern Ontario, the ratio of nitrates in nitric acid to nitrates in particulates is greater than two to one with somewhat greater values in summer than winter (Tang, 1986). In southern Ontario, where there may be more interaction of nitric acid vapor with windblown dust (due to agricultural and other anthropogenic activities), these two forms of nitrates are of comparable importance. For the purpose of this study, the deposition velocity of nitric acid (the dominant form) is used to calculate the dry deposition rate of nitrates.

The dry deposition velocities were estimated on a monthly basis at each node of a 127 km grid system over the province. The annual average dry deposition velocities at APIOS sampling sites were calculated from the values of the surrounding four nodes. The annual average dry deposition velocities for SO_2, SO_4 and NO_3 are given in Figures 2 to 4; they are in the range 0.17-0.38, 0.16-0.40 and 0.53-3.0 cm s^{-1}, respectively. These values are slightly different from those

given in the report on the 1982 data (Chan et al. 1985[a]), since then the annual average dry deposition velocities at APIOS sites were approximated from the value of the nearest node. In general, the present and previous dry deposition velocities are quite similar except for sites near the shore of the Great Lakes.

Estimates of dry deposition velocities for the other airborne contaminants measured in this study may be found in Chan et al. (1985a).

3. RESULTS AND DISCUSSION

3.1. Precipitation Samples

The annual average precipitation concentration and the total wet deposition values listed in Tables 1 and 2 are presented in the form of isopleth maps. The isopleth map for vanadium is not given because most of the observed values are at the analytical detection limits.

3.1.1 Annual Precipitation Depth

Figure 5 shows the isopleths of the 1983 annual precipitation depth in Ontario based on Environment Canada's climatological data. In general, there is a southeast to northwest gradient of precipitation amount in Ontario. The precipitation amount ranges from 60 cm in the northwestern part of Ontario to 110 cm in the southern part of Ontario.

3.1.2 Annual Precipitation Concentration and Wet Deposition

3.1.2.1 H_f^+ and H_t^+:

The spatial patterns of annual average precipitation concentration and wet deposition of free hydrogen (H_f^+) and total hydrogen (H_t^+) are similar in 1983 (see Figures 6a, 6b, 7a and 7b). There is a several-fold decrease in both concentration and deposition from the southern to the northern areas of the province. The ranges of H_f^+ concentration and wet deposition are about 10 to 60 ug/l and 4 to 54 mg/m^2, respectively. The ranges of H_t^+ concentration and deposition are about 20 to 90 ug/l and 10 to 90 mg/m^2, respectively. It is interesting to note that, as in the earlier data (Chan et al., 1984[a]), the concentration of total hydrogen ions is appreciably greater than that of free hydrogen ions, especially in the northern parts of the province.

3.1.2.2 $SO_4^=$ and $N\text{-}NO_3^-$

There are some similar features in the spatial patterns of concentration and deposition of sulfate and nitrate (see Figure 8a, 8b, 9a and 9b). The maps for both sulfate and nitrate show a general south to north gradient in Ontario, with concentration values in southestern

Ontario about three or four times higher than those at the northernmost sites, and an even larger difference in the annual wet deposition values. These results reflect the influence of the source areas of sulfur and nitrogen oxide emissions in southern Ontario and the northeastern United States on the precipitation chemistry measurements. As in previous years, the target loading of 20 kg SO_4/ha.y (2 g $SO_4/m^2.y$) is exceeded in all of central and southern Ontario.

3.1.2.3 $N\text{-}NH_4^+$ and N-TKN

The annual average concentration and deposition of $N\text{-}NH_4$ and N-TKN are given in Figures 10a, 10b, 11a and 11b. There is a general south to north gradient with the highest values of both the annual averaged concentration and deposition in the West Central Region. The concentration values differ by a factor of two to three across the province.

3.1.2.4 $P\text{-}PO_4^{-3}$

The spatial patterns of the annual average concentration and deposition of $P\text{-}PO_4^{-3}$ are given in Figures 12a and 12b. There is no general gradient of $P\text{-}PO_4^{-3}$ in Ontario. The values of both concentration and deposition are fairly uniform across the province with elevated values at some stations, possibly due to local contamination effects.

3.1.2.5 Cu and Ni

The concentration and deposition results of Cu and Ni are shown in Figures 13a to 14b. As with the phosphorous results, there is no systematic pattern in the observations for these trace metals, which are of interest because of the potential impact of the large nickel smelters at Sudbury. The present results indicate that, whereas within the Sudbury Basin, smelter operations have a large impact on precipitation levels of Cu and Ni (Chan et al., 1984[c]), in the province as a whole, precipitation Cu and Ni values are dominated by non-anthropogenic factors - e.g., windblown dust.

3.1.2.6 Fe, Al, Ca^{++}, Mg^{++} and K^{+}

The major source of these parameters is thought to be windblown soil. Their precipitation concentration and wet deposition fields are shown in Figures 15a to 19b. Values are somewhat elevated in the southern portions of the province, where most of the agricultural and urbanized areas are located. The occasional elevated values at individual sites are thought to be due to local contamination by windblown dust.

3.1.2.7 Pb, Zn, Mn, and Cd

The results for these metals are shown in Figures 20a to 23b. An important source of airborne lead particulates in vehicular traffic, and the observed patterns reflect this, with concentration and deposition rates decreasing with distance from the large urban areas in southern Ontario and the northeastern United States. Wet deposition rates of Pb in the lower Great Lakes area is seen to be around 6 $mg/m^2.y$. Results for Zn are similar to those for Pb. Mn possibly has a stronger soil-related source than the above two metals, and shows a somewhat different pattern. The Cd data show little large-scale spatial variation, and annual wet deposition rates in the lower Great Lakes area of about 100 ug/m^2.

3.1.2.8 Na^{+} and Cl^{-}

A major source of Na^{+} and Cl^{-} is thought to be salt, and Figures 24a to 25b do suggest a common source, since the concentration and deposition patterns are broadly similar. However, additional factors are indicated, because the relative concentrations of Na and Cl are generally somewhat different than one would expect if salt were the only source (in salt, the Na/Cl mass ratio is 0.66).

3.1.3 Seasonal Variation in Precipitation Concentration and Wet Deposition

The seasonal averaged precipitation concentration and wet deposition values are listed in Tables 5 to 12 under the heading of Winter 82/83 (from November 30/82 to March 2/83), Spring 83 (from March 2/83 to May 25/83), Summer 83 (from May 25/83 to September 14/83) and Autumn 83 (from September 14/83 to December 7/83).

Seasonal variability will be studied when more than four years of data are available, hence no detailed discussion of seasonal variation is given here. Readers are encouraged to refer to the tables for specific information.

3.2 Air Samples

The annual average air concentration and dry deposition values listed in Tables 3 and 4 are presented in the form of isopleth maps. The notation used in these maps is the same as in the figures of precipitation samples.

3.1.1 Air Concentrations

3.2.1 $N\text{-}NO_3$, SO_4, SO_2 and total S

The spatial patterns of air concentration of $N\text{-}NO_3$ (sum of particulate nitrate and nitric acid vapour), particulate SO_4, gaseous SO_2, and total airborne sulfur (sum of contributions from sulfates and SO_2) are all similar (Figures 26-29). In all these figures, there is a south to north gradient, with the highest levels in southern Ontario, near the emission source areas. For SO_2 and nitrates, annual average concentrations in the southernmost portions of the province are about an order of magnitude greater than those in the northern areas: for particulate SO_4, the difference is somewhat smaller. In southern Ontario, most of the atmospheric sulfur is in the particulate form; in northern Ontario, the gasesous and particulate fractions are comparable.

3.2.1.2 Fe, Al, Ca^{++}, Mg^{++} and K^{+}

The general comments made about precipitation concentrations of these parameters also apply to the air concentrations. The elevated values in southern Ontario (Figures 30-34) probably reflect urbanization and agricultural activities, as these elements are largely soil-derived.

3.2.1.3 Cu and Ni

The concentration fields for Cu and Ni are shown in Figures 35 and 36. Whereas Cu shows a slight decrease in concentration going northwards from southern Ontario, the Ni concentrations seem to be fairly uniform across the province.

3.2.1.4 V

The spatial pattern of V is unique (see Figure 37), in that there is a rather pronounced west to east gradient. These results are difficult to interpret. Although there is a large source of V emissions in the northeastern United States (from oil combustion), the prevailing wind flows are from west to east, placing Ontario upwind of the source area.

3.2.1.5 Pb, Zn, Mn and Cd

The spatial patterns of Pb, Zn, and Mn are similar (see Figures 38, 39 and 40). In all figures, there is a southeast to northwest gradient, which is somewhat greater than in the corresponding precipitation data. The Cd concentrations also follow the same pattern (Figure 41), although there seems to be an area in Central Ontario with relatively low values.

3.2.1.6 Na^+ and Cl^-

The air concentration patterns of Na^+ and Cl^- (Figures 42 and 43), although resembling each other in the general features, are not as similar as the precipitation concentration patterns (Figures 24a and 25a). The gradient in Cl^- values seems to be much larger than that in Na^+ values. The reason for these observations is unclear. Possibly there are significant sources of chlorides (e.g. coal combustion, incineration) other than road salt, but the distribution of these chlorides between gasesous and particulate forms is unknown (note - the APIOS network only reports the chlories collected on the particulate filter).

3.2.2 Seasonal Variation in Air Concentration

Seasonal averaged air concentration values are listed in Tables 15 to 18 under the heading Winter 82, 83 (from November 30, 82 to March 2, 83), Spring 1983 (from March 2, 1983 to May 25, 1983), Spring 1983 (from May 25, 1983 to September 14, 1983) and Autumn 1983 (from September 14, 1983 December 7, 1983).

Seasonal varability will be studied when more than four years data are available, hence no discussion of seasonal variability is given here. Readers are encouraged to refer to the tables for specific information.

3.2.3 Dry Deposition of $S\text{-}SO_4$, $S\text{-}SO_2$ and $N\text{-}NO_3$

The spatial patterns of dry deposition of sulfur and nitrogen compounds resemble those of their air concentrations (compare figures 44-46 and 26-29), with a decrease as one goes from southern to northern Ontario. Note that in southern Ontario, most of the atmospheric sulfur deposition is due to SO_2; in northern Ontario, particulate SO_4 contributes a somewhat larger share of the sulfur dry deposition.

3.3 Comparison of Wet and Dry Deposition

A comparison of Figures 8b, 44 and 45 indicates that wet deposition rates of sulfur compounds exceeded dry deposition rates by a factor of about 3-4 in most of the province. For nitrates, wet and dry deposition rates were similar, the wet deposition being slightly higher (Figures 9b and 46). It should be noted that the nitrogen values are based on measurements of nitrates only. Species such as nitrogen dioxide and nitric oxide were not measured, but probably contribute significantly to the atmospheric burden of nitrogen compounds. However, our estimates of nitrogen dry deposition, based on the assumption that all nitrates exist as nitric acid, are probably high, so there may be some compensation of errors, giving a reasonable overall atmospheric nitrogen dry deposition rate.

REFERENCES

Atmospheric Environmental Service (1983), Daily Climate Data Tape, Canadian Climate Center, Downsview, Ontario.

Chan, W.H., Tang, A.J.S. and Lusis, M.A. (1983), "Precipitation Concentration and Wet Deposition Fields of Pollutants in Ontario, September 1980 to December 1981". Ontario Ministry of the Environment report #ARB-61-83-ARSP.

Chan, W.H., Chung, D.H.S. and Tang, A.J.S. (1984[a]), "Precipitation Concentration and Wet Deposition Fields of Pollutants in Ontario, 1982". Ontario Ministry of the Environment report #ARB-142-84-ARSP.

Chan, W.H., Orr, D.B. and Vet, R.J. (1984[b]), "The Acidic Precipitation in Ontario Study (APIOS) - An Overview. The Cumulative Wet/Dry Deposition Network". Ontario Ministry of the Environment report #ARB-164-83-ARSP.

Chan, W.H., Vet, R.J., Ro, C.V., Tang, A.J.S. and Lusis, M.A. (1984[c]), "Impact of Inco Smelter Emissions on Wet and Dry Deposition in the Sudbury Area", Atmos. Environ., 18, 1001-1008.

Chan, W.H. Tang, A.J.S., Lusis, M.A. and Chung D.H.S. (1985[a]), "Air Concentration and Dry Deposition Fields of Pollutants in Ontario - 1982". Ontario Ministry of the Environment report #ARB-001-85-ARSP.

Chan, W.H. Tang, A.J.S., Orr, D.B., Bardswick, W.S. and Lusis, M.A. (1985[b]), "An Evaluation of Sampler Types and Sampling Periods for Measurements of Wet and Dry Deposition", Ontario Ministry of the Environment report # ARB-98-85-AQM.

Masse, C. and Voldner, E.C. (1983). "Estimation of Dry Deposition Velocities of Sulfur over Canada and the United States East of the Rocky Mountains. Precipitation Scavenging, Dry Deposition and Resuspension", Proceedings of the Fourth International Conference, Santa Monica, California, 29 November - 3 December, 1982, Pruppacher et al. Eds. (Elsevier, New York) 991-1001.

Ontario Ministry of the Environment (1985[a]), "Cumulative Ambient Air Concentration Listings, January 5, 1983 - January 4, 1984", Report ARB-ARSP.

Ontario Ministry of the Environment (1985[b]), "Cumulative (28 Day) Precipitation Chemistry Listings, January 5, 1983 - January 4, 1984". Ontario Ministry of the Environment report #ARB-ARSP.

Sheih, C.M., Wesely, M.L. and Hicks, B.B. (1979), "A Guide for Estimating Dry Deposition Velocities of Sulfur Over the Eastern United States and Surrounding Regions". Argonne National Laboratory Report ANL/RER-79-2.

Tang, A.J.S. and Chan, W.H. (1985), "Spatial Trend Analysis and Uncertainty Estimates of Acid Precipitation Data in Ontario". The 78th APCA annual meeting and exhibition, Detroit, Michigan, U.S.A. Paper #85-6A.6.

Tang, A.J.S. (1986), "Analysis of Airborne Nitrates From the APIOS Daily Sampling Network", Memo to APIOS File AP-09-3-01.

Voldner, E.C., Barrie, L.A. and Sirois, A. (1985). A Literature Review of Dry Deposition of Oxides of Sulphur and Nitrogen with Emphasis on Long Range Transport Modelling in North America, to be submitted to Atmospheric Environment for publication.

Wesely, M.L. and Shannon, J.L. (1984), "Improved Estimates of Sulfate Dry Deposition in Eastern North America". Environmental Progress, 3, 78-81.

TABLE 1:

Annual Average Precipitation Concentration (mg/l) - 1983.

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4
1	0.0549	0.0882	4.17	0.524	0.457	0.188	0.535	0.1093	0.0412	0.0624	0.451
2	0.0458	0.0757	4.37	0.597	0.807	0.246	0.493	0.1511	0.0557	0.1096	0.409
3	0.0590	0.0844	4.28	0.571	0.615	0.238	0.607	0.1176	0.0623	0.0855	0.453
4	0.0625	0.0956	4.64	0.622	0.689	0.218	0.582	0.0882	0.0528	0.0943	0.495
5	0.0477	0.0791	3.77	0.509	0.505	0.217	0.526	0.0905	0.0916	0.0902	0.411
6	0.0410	0.0705	4.46	0.568	0.709	0.148	0.713	0.1251	0.0370	0.0559	0.625
7	0.0431	0.0723	3.48	0.506	0.423	0.187	0.882	0.1059	0.0692	0.0823	0.615
8	0.0268	0.0520	3.43	0.507	0.554	0.147	0.724	0.1441	0.0408	0.0822	0.602
9	0.0495	0.0905	3.32	0.563	0.348	0.126	0.541	0.0674	0.0351	0.0517	0.469
10	0.0344	0.0434	4.46	0.587	0.984	0.345	0.629	0.2373	0.0576	0.1398	0.567
11	0.0367	0.0560	3.73	0.603	0.843	0.218	0.645	0.0848	0.0369	0.0825	0.458
12	0.0429	0.0550	2.74	0.482	0.310	0.176	0.367	0.0681	0.0530	0.0720	0.467
13	0.0268	0.0502	3.56	0.529	0.582	0.151	0.691	0.0682	0.0694	0.0575	0.492
15	0.0279	0.0595	2.34	0.383	0.378	0.137	0.334	0.0630	0.0254	0.0808	0.272
16	0.0287	0.0513	2.60	0.402	0.450	0.147	0.702	0.0522	0.0459	0.0780	0.457
17	0.0391	0.0637	2.54	0.394	0.229	0.102	0.371	0.0366	0.0427	0.0526	0.279
18	0.0483	0.0726	2.72	0.448	0.207	0.095	0.340	0.0324	0.0281	0.0409	0.293
19	0.0435	0.0702	2.74	0.351	0.170	0.068	0.355	0.0301	0.0369	0.0382	0.279
20	0.0474	0.0697	2.46	0.436	0.197	0.085	0.366	0.0305	0.0243	0.0418	0.292
21	0.0453	0.0725	2.82	0.431	0.228	0.126	0.403	0.0404	0.0350	0.0615	0.328
22	0.0408	0.0602	2.64	0.301	0.159	0.089	0.335	0.0234	0.0315	0.0399	0.207
23	0.0580	0.0922	3.15	0.524	0.228	0.102	0.508	0.0390	0.0401	0.0364	0.384
24	0.0565	0.0783	2.65	0.468	0.163	0.151	0.474	0.0258	0.0965	0.0607	0.285
25	0.0310	0.0531	1.67	0.256	0.124	0.137	0.296	0.0201	0.0356	0.0793	0.210
26	0.0188	0.0393	1.74	0.308	0.110	0.070	0.238	0.0358	0.0605	0.0396	0.202
26A	0.0431	0.0687	2.35	0.298	0.127	0.085	0.296	0.0266	0.0423	0.0417	0.221
27	0.0243	0.0577	1.76	0.218	0.178	0.099	0.213	0.0329	0.0352	0.0575	0.175
28											
29	0.0247	0.0469	1.49	0.306	0.440	0.598	0.191	0.1301	0.0336	0.3229	0.126
30	0.0126	0.0272	1.21	0.195	0.160	0.052	0.326	0.0210	0.0337	0.0372	0.237
30A	0.0157	0.0539	2.15	0.307	0.224	0.134	0.389	0.0298	0.0264	0.0711	0.263
31	0.0235	0.0478	1.47	0.231	0.166	0.066	0.326	0.0229	0.0292	0.0454	0.177
32	0.0110	0.0306	1.22	0.213	0.184	0.053	0.318	0.0298	0.0483	0.0420	0.255
33	0.0097	0.0282	1.13	0.232	0.217	0.038	0.349	0.0335	0.0412	0.0325	0.241
34	0.0082	0.0277	1.23	0.270	0.260	0.072	0.439	0.0513	0.0669	0.0434	0.347
35	0.0149	0.0311	1.35	0.242	0.194	0.071	0.360	0.0512	0.0689	0.0426	0.267
36	0.0099	0.0264	1.01	0.163	0.162	0.080	0.283	0.0313	0.0476	0.0402	0.156
37	0.0272	0.0456	1.50	0.278	0.091	0.067	0.242	0.0185	0.0114	0.0309	0.199

* CONCENTRATIONS ARE GEOMETERIC MEAN VALUES. NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 1(CONTINUED)

ID	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	0.0118	0.00472	0.000805	0.01383	0.0669	0.00674	0.00100	0.0776	0.00104	0.000138
2	0.0160	0.00583	0.001304	0.01092	0.0923	0.00640	0.00100	0.0971	0.00117	0.000143
3	0.0293	0.00516	0.000730	0.00727	0.0672	0.00675	0.00100	0.0774	0.00111	0.000124
4	0.0105	0.00497	0.001141	0.01044	0.0855	0.00803	0.00100	0.0819	0.00157	0.000173
5	0.0217	0.00439	0.001205	0.00994	0.0624	0.00702	0.00100	0.0819	0.00262	0.000275
6	0.0135	0.00563	0.000654	0.01005	0.1161	0.00946	0.00100	0.1010	0.00126	0.000221
7	0.0317	0.00419	0.000655	0.00664	0.0502	0.00709	0.00100	0.0538	0.00120	0.000080
8	0.0222	0.00451	0.000630	0.00893	0.0595	0.00467	0.00100	0.0622	0.00121	0.000204
9	0.0138	0.00334	0.000609	0.00592	0.0417	0.00595	0.00100	0.0488	0.00124	0.000103
10	0.0132	0.00691	0.000531	0.00999	0.0674	0.00763	0.00100	0.0550	0.00215	0.000073
11	0.0213	0.00439	0.000567	0.00633	0.0598	0.00584	0.00100	0.0562	0.00142	0.000152
12	0.0259	0.00305	0.000618	0.00661	0.0372	0.00516	0.00100	0.0293	0.00127	0.000189
13	0.0296	0.00455	0.001031	0.00599	0.0835	0.00724	0.00100	0.0844	0.00271	0.000106
15	0.0063	0.00377	0.000598	0.00551	0.0466	0.00616	0.00100	0.0439	0.00108	0.000081
16	0.0168	0.00591	0.000657	0.00813	0.0424	0.00573	0.00125	0.0414	0.00142	0.000089
17	0.0092	0.00303	0.000557	0.00489	0.0435	0.00541	0.00100	0.0432	0.00172	0.000078
18	0.0078	0.00237	0.000500	0.00389	0.0355	0.00523	0.00100	0.0412	0.00098	0.000070
19	0.0087	0.00226	0.000564	0.00534	0.0325	0.00537	0.00100	0.0336	0.00131	0.000089
20	0.0068	0.00195	0.000581	0.00390	0.0240	0.00579	0.00100	0.0270	0.00096	0.000084
21	0.0096	0.00265	0.000616	0.00494	0.0431	0.00489	0.00100	0.0404	0.00127	0.000079
22	0.0281	0.00470	0.002015	0.00365	0.0584	0.00567	0.00100	0.0748	0.00169	0.000080
23	0.0115	0.00252	0.000662	0.00810	0.0414	0.00504	0.00100	0.0426	0.00143	0.000100
24	0.0225	0.00260	0.000712	0.00951	0.0332	0.00776	0.00100	0.0347	0.00234	0.000215
25	0.0133	0.00186	0.000590	0.00563	0.0321	0.00425	0.00100	0.0337	0.00139	0.000100
26	0.0201	0.00254	0.000500	0.00491	0.0261	0.00210	0.00100	0.0344	0.00165	0.000059
26A	0.0070	0.00160	0.000500	0.00713	0.0254	0.00294	0.00100	0.0270	0.00152	0.000098
27	0.0063	0.00205	0.000749	0.00362	0.0275	0.00439	0.00100	0.0290	0.00162	0.000108
28	.	.	.	.	.	.	.	.	.	.
29	0.0051	0.00154	0.000500	0.01556	0.0371	0.00554	0.00100	0.0131	0.00175	0.000209
30	0.0111	0.00146	0.000500	0.00214	0.0118	0.00116	0.00100	0.0207	0.00121	0.000072
30A	0.0103	0.00269	0.000594	0.00414	0.0583	0.00423	0.00100	0.0557	0.00153	0.000111
31	0.0108	0.00191	0.000532	0.00346	0.0316	0.00240	0.00100	0.0290	0.00104	0.000071
32	0.0070	0.00334	0.000717	0.00319	0.0334	0.00193	0.00100	0.0377	0.00107	0.000055
33	0.0131	0.00605	0.001187	0.00295	0.0726	0.00327	0.00100	0.0568	0.00107	0.000122
34	0.0104	0.00385	0.000574	0.00485	0.0555	0.00218	0.00100	0.0626	0.00180	0.000074
35	0.0225	0.00374	0.000622	0.00428	0.0681	0.00214	0.00100	0.0689	0.00189	0.000105
36	0.0168	0.00315	0.000829	0.00378	0.0422	0.00223	0.00100	0.0403	0.00204	0.000095
37	0.0066	0.00143	0.000500	0.00232	0.0163	0.00236	0.00100	0.0185	0.00070	0.000061

TABLE 2:

Annual Wet Deposition (mg/m^2) in Ontario - 1983.

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	46.8	75.2	3556	446.7	390.1	160.4	456.7	93.3	35.2	53.2	384.8	10.1	4.02	0.7	11.79	57.0	5.75	0.853	66.2	0.89	0.118
2	38.5	63.6	3669	501.3	677.5	206.5	414.5	126.9	46.8	92.0	344.0	13.4	4.90	1.1	9.17	77.5	5.38	0.840	81.6	0.98	0.120
3	55.7	79.6	4040	538.7	580.5	225.0	573.1	111.0	58.8	80.7	427.7	27.7	4.87	0.7	6.86	63.4	6.37	0.944	73.1	1.05	0.117
4	53.1	81.2	3941	527.9	585.3	185.2	494.6	74.9	44.9	80.1	420.1	8.9	4.22	1.0	8.86	72.6	6.82	0.849	69.6	1.33	0.147
5	47.1	78.0	3722	502.3	497.4	214.1	519.1	89.2	90.3	89.0	405.2	21.4	4.33	1.2	9.80	61.6	6.92	0.986	80.7	2.58	0.271
6	32.4	55.7	3527	449.0	560.1	116.8	563.4	98.8	29.2	44.2	494.1	10.7	4.45	0.5	7.94	91.7	7.48	0.790	79.8	1.00	0.175
7	39.1	65.6	3156	459.1	383.3	170.0	799.5	96.0	62.8	74.6	558.0	28.8	3.80	0.6	6.02	45.5	6.43	0.907	48.8	1.09	0.072
8	20.3	39.4	2597	384.3	419.9	111.4	548.8	109.2	37.0	62.3	456.0	16.9	3.42	0.5	6.77	45.1	3.54	0.758	47.1	0.92	0.155
9	48.6	88.8	3260	552.6	341.6	123.2	530.5	66.1	34.4	50.7	459.7	13.6	3.28	0.6	5.80	40.9	5.83	0.981	47.9	1.22	0.101
10	27.8	35.1	3607	475.1	796.2	278.7	509.1	240.5	46.6	113	458.5	10.7	5.59	0.4	8.08	54.5	6.18	0.809	44.5	1.74	0.059
11	27.5	42.0	2798	451.9	631.6	163.0	483.7	63.6	27.6	61.8	343.4	15.9	3.29	0.4	4.75	44.8	4.38	0.749	42.1	1.06	0.114
12	35.8	46.0	2292	403.1	259.0	147.1	306.8	56.9	44.3	60.2	390.6	21.6	2.55	0.5	5.53	31.1	4.31	0.836	24.5	1.06	0.158
13	23.1	43.1	3053	454.1	499.5	129.8	593.5	58.6	59.6	49.4	422.3	25.4	3.91	0.9	5.15	71.7	6.22	0.859	72.5	2.33	0.091
15	23.1	49.3	1941	317.4	312.7	113.3	276.3	52.2	21.1	67.0	224.9	5.2	3.12	0.5	4.56	38.6	5.10	0.828	36.3	0.89	0.067
16	29.1	52.0	2632	406.8	456.1	149.1	710.8	52.8	46.5	79.0	463.1	17.0	5.99	0.7	8.23	42.9	5.81	1.264	42.0	1.44	0.090
17	33.4	54.4	2168	336.4	195.6	86.7	317.2	31.3	36.4	44.9	238.3	7.8	2.59	0.5	4.17	37.1	4.62	0.854	36.9	1.47	0.067
18	47.0	70.7	2651	436.1	201.2	92.7	331.1	31.6	27.4	39.8	284.9	7.6	2.31	0.5	3.79	34.5	5.09	0.973	40.1	0.95	0.068
19	36.0	58.1	2268	290.8	140.6	56.5	294.0	25.0	30.5	31.6	231.1	7.2	1.87	0.5	4.42	26.9	4.45	0.828	27.8	1.08	0.074
20	45.8	67.4	2374	421.7	190.2	82.2	354.3	29.5	23.5	40.4	282.1	6.6	1.88	0.6	3.77	23.2	5.60	0.967	26.1	0.93	0.081
21	50.3	80.6	3136	479.5	253.3	140.5	447.6	44.8	38.9	68.3	364.8	10.6	2.94	0.7	5.49	47.9	5.43	1.111	44.9	1.41	0.087
22	38.7	57.1	2510	285.8	151.4	85.0	318.4	22.2	29.9	37.9	196.8	26.7	4.47	1.9	3.46	55.5	5.39	0.950	71.1	1.60	0.076
23	53.8	85.4	2918	485.2	211.6	95.0	471.0	36.2	37.1	33.8	355.6	10.7	2.34	0.6	7.51	38.4	4.67	0.927	39.5	1.33	0.092
24	19.1	26.4	892	157.8	55.0	51.0	160.0	8.7	32.5	20.5	96.0	7.6	0.88	0.2	3.21	11.2	2.62	0.337	11.7	0.79	0.073
25	22.1	37.9	1193	182.5	88.4	97.4	210.9	14.4	25.4	56.5	149.9	9.5	1.33	0.4	4.01	22.9	3.03	0.713	24.0	0.99	0.071
26	7.1	14.9	659	116.4	41.8	26.6	90.1	13.6	22.9	15.0	76.5	7.6	0.96	0.2	1.86	9.9	0.80	0.379	13.0	0.62	0.022
26A	17.1	27.4	937	118.5	50.6	34.0	117.8	10.6	16.9	16.6	87.9	2.8	0.64	0.2	2.84	10.1	1.17	0.398	10.7	0.60	0.039
27	19.0	45.1	1375	170.7	139.2	77.3	166.8	25.8	27.5	45.0	137.1	4.9	1.60	0.6	2.83	21.5	3.43	0.782	22.7	1.27	0.084
28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	1.8	3.4	107	22.0	31.7	43.0	13.7	9.4	2.4	23.2	9.1	0.4	0.11	0.0	1.12	2.7	0.40	0.072	0.9	0.13	0.015
30	5.9	12.6	565	90.9	74.3	24.2	152.0	9.8	15.7	17.3	110.3	5.2	0.68	0.2	0.99	5.5	0.54	0.465	9.6	0.56	0.033
30A	3.7	12.8	511	72.9	53.3	31.8	92.4	7.1	6.3	16.9	62.6	2.5	0.64	0.1	0.98	13.9	1.01	0.238	13.2	0.36	0.026
31	18.3	37.1	1139	179.1	129.1	51.1	252.9	17.8	22.7	35.3	137.8	8.4	1.48	0.4	2.68	24.5	1.86	0.777	22.5	0.81	0.055
32	9.7	26.9	1074	187.3	161.5	46.6	280.0	26.2	42.5	36.9	224.2	6.2	2.94	0.6	2.81	29.4	1.70	0.800	33.2	0.94	0.048
33	4.9	14.3	573	117.9	110.5	19.2	177.7	17.1	21.0	16.5	122.4	6.7	3.08	0.6	1.50	36.9	1.66	0.509	28.9	0.55	0.062
34	3.8	12.9	574	125.7	121.0	33.4	204.6	23.9	31.2	20.2	161.9	4.8	1.80	0.3	2.26	25.9	1.02	0.466	29.2	0.84	0.034
35	8.9	18.6	807	144.9	116.0	42.4	215.6	30.7	41.3	25.5	159.7	13.5	2.24	0.4	2.56	40.8	1.28	0.599	41.2	1.13	0.063
36	5.3	14.2	543	88.0	87.1	43.3	152.5	16.9	25.6	21.6	84.0	9.0	1.70	0.4	2.04	22.7	1.20	0.538	21.7	1.10	0.051
37	16.4	27.6	904	168.0	55.2	40.8	146.0	11.2	6.9	18.7	120.4	4.0	0.86	0.3	1.40	9.8	1.43	0.604	11.2	0.42	0.037

* NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 3:

Annual Average Air Concentration (ug/m^3) in Ontario - 1983.

ID	SO2	SO4	S	N_NO3	CL	CA	MG	K	NA	FE	AL	PB	MN	CU	NI	VN	ZN	CD
1	13.68	5.30	8.88	1.09	0.53	0.59	0.171	0.078	0.146	0.109	0.070	0.079	0.0078	0.0028	0.00050	0.0008	0.041	0.00041
3	9.62	5.32	7.14	1.02	0.47	0.55	0.105	0.080	0.125	0.110	0.075	0.062	0.0101	0.0021	0.00043	0.0007	0.027	0.00042
4	16.29	5.49	9.79	1.06	0.62	0.97	0.134	0.072	0.153	0.103	0.077	0.068	0.0085	0.0026	0.00041	0.0010	0.033	0.00041
8	5.34	4.93	4.49	0.86	0.39	0.60	0.198	0.059	0.115	0.064	0.045	0.050	0.0058	0.0020	0.00059	0.0008	0.019	0.00023
9	4.40	4.17	3.79	0.61	0.29	0.30	0.080	0.051	0.121	0.056	0.037	0.037	0.0046	0.0014	0.00051	0.0007	0.013	0.00027
10	7.51	4.69	5.81	0.81	0.54	0.99	0.351	0.084	0.205	0.141	0.054	0.134	0.0148	0.0029	0.00056	0.0010	0.038	0.00052
11	4.86	4.24	4.13	0.60	0.34	1.06	0.080	0.072	0.152	0.070	0.047	0.049	0.0064	0.0019	0.00041	0.0008	0.020	0.00027
13	3.76	3.59	3.21	0.54	0.27	1.06	0.063	0.067	0.140	0.071	0.050	0.050	0.0059	0.0016	0.00046	0.0011	0.014	0.00028
15	2.95	3.14	2.77	0.47	0.31	0.78	0.312	0.065	0.159	0.068	0.033	0.053	0.0129	0.0018	0.00043	0.0012	0.018	0.00024
16	3.85	4.13	3.49	0.50	0.44	0.60	0.082	0.120	0.209	0.084	0.064	0.065	0.0127	0.0025	0.00072	0.0029	0.024	0.00036
17	2.20	2.93	2.25	0.26	0.14	0.12	0.041	0.058	0.110	0.047	0.027	0.032	0.0042	0.0016	0.00067	0.0012	0.010	0.00029
20	3.23	2.98	2.78	0.30	0.14	0.09	0.042	0.040	0.073	0.065	0.041	0.023	0.0025	0.0018	0.00034	0.0006	0.011	0.00030
21	4.09	3.07	3.15	0.31	0.20	0.13	0.032	0.046	0.124	0.050	0.025	0.033	0.0024	0.0016	0.00031	0.0006	0.010	0.00032
22	3.00	2.72	2.55	0.19	0.17	0.12	0.051	0.073	0.124	0.129	0.058	0.039	0.0049	0.0020	0.00048	0.0008	0.013	0.00037
23	5.13	3.01	3.85	0.31	0.16	0.13	0.039	0.051	0.092	0.046	0.027	0.029	0.0030	0.0022	0.00043	0.0006	0.008	0.00038
25	2.95	2.36	2.35	0.16	0.11	0.08	0.033	0.042	0.089	0.053	0.034	0.022	0.0027	0.0027	0.00050	0.0007	0.011	0.00038
27	1.53	1.84	1.39	0.09	0.14	0.18	0.062	0.037	0.104	0.047	0.032	0.016	0.0023	0.0014	0.00041	0.0007	0.006	0.00023
28	0.95	2.77	1.39	0.06	0.75	1.71	0.549	0.095	0.335	0.128	0.038	0.033	0.0062	0.0016	0.00089	0.0017	0.018	0.00020
30	0.16	0.99	0.43	0.07	0.06	0.12	0.038	0.020	0.120	0.026	0.013	0.005	0.0011	0.0006	0.00033	0.0007	0.005	0.00006
30A	1.21	1.99	1.26	0.11	0.14	0.29	0.091	0.039	0.102	0.112	0.035	0.015	0.0027	0.0009	0.00034	0.0007	0.004	0.00009
31	0.71	1.24	0.66	0.08	0.06	0.08	0.036	0.029	0.077	0.040	0.028	0.009	0.0023	0.0006	0.00036	0.0007	0.003	0.00007
35	0.54	1.27	0.67	0.10	0.08	0.09	0.036	0.034	0.084	0.056	0.033	0.014	0.0022	0.0006	0.00044	0.0007	0.003	0.00007
36	0.46	1.36	0.68	0.07	0.06	0.16	0.053	0.031	0.085	0.047	0.029	0.015	0.0021	0.0015	0.00066	0.0006	0.003	0.00008
37	2.53	1.27	1.70	0.17	0.08	0.02	0.019	0.017	0.093	0.018	0.010	0.006	0.0017	0.0010	0.00032	0.0006	0.003	0.00015

[redacted] * [redacted]ER U[redacted]LINE[redacted]RRES[redacted] TO [redacted]HII[redacted]RE [redacted]HAN[redacted]THI[redacted]COMP[redacted]

TABLE 4. 1983 Annual Dry Deposition ($g\ m^{-2}\ y^{-1}$)

AREA	SITE NUMBER	SO_2	SO_4	$N\text{-}NO_3$
SOUTHERN ONTARIO	1	1.34	0.43	0.41
	3	0.94	0.40	0.33
	4	1.59	0.43	0.36
	8	0.51	0.34	0.28
	9	0.53	0.47	0.20
	10	0.66	0.33	0.31
	11	0.40	0.28	0.25
	13	0.37	0.35	0.26
CENTRAL ONTARIO	15	0.20	0.27	0.31
	16	0.27	0.26	0.22
	17	0.12	0.32	0.25
	20	0.18	0.36	0.30
	21	0.34	0.38	0.25
	22	0.18	0.32	0.17
	23	0.44	0.38	0.28
NORTHERN ONTARIO	25	0.16	0.27	0.16
	27	0.08	0.19	0.08
	28	0.08	0.14	0.01
	30	0.01	0.10	0.06
	31	0.05	0.14	0.06
	35	0.03	0.14	0.08
	36	0.03	0.13	0.06
	37	0.09	0.18	0.10

TABLE 5:

Seasonal Gauge Depth Weighted Mean Precipitation Concentration (mg/l)

SEASON = WINTER 82/83

ID	HF	NT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4
1	0.0895	0.1307	5.11	1.118	0.468		0.553	0.2682	0.0579		0.543
2	0.0364	0.0681	3.90	0.737	0.878	0.469	0.571	0.2195	0.0399	0.2494	0.377
3	0.1027	0.1412	4.14	0.762	1.095	0.380	0.504	0.2175	0.0496	0.1805	0.396
4	0.0686	0.1169	4.49	0.805	0.860	0.457	0.810	0.1009	0.0632	0.1798	0.660
5	0.0631	0.1036	2.89	0.585	0.339	0.347	0.412	0.0739	0.0872	0.1476	0.327
6	0.0436	0.0631	2.97	0.579	0.462	0.283	0.453	0.1439	0.0275	0.1193	0.400
7	0.0495	0.0811	2.30	0.537	0.305	0.272	0.395	0.0855	0.0167	0.1084	0.341
8	0.0386	0.0725	3.52	0.837	0.865	0.334	0.684	0.3100	0.0302	0.1615	0.633
9	0.0813	0.1149	3.35	0.804	0.288	0.285	0.611	0.0695	0.0250	0.1437	0.535
10	0.0263	0.0454	3.84	0.565	1.140	0.726	0.561	0.4900	0.0301	0.3895	0.376
11	0.0572	0.0852	2.59	0.560	0.339	0.264	0.457	0.0313	0.0113	0.1416	0.279
12	0.0422	0.0723	1.45	0.384	0.147	0.186	0.244	0.0278	0.0269	0.0869	0.200
13	0.0334	0.0599	1.25	0.296	0.162	0.150	0.315	0.0182	0.0181	0.0673	0.160
15	0.0357	0.0610	1.42	0.320	0.124	0.171	0.208	0.0345	0.0135	0.0834	0.178
16	0.0226	0.0520	1.99	0.405	0.616	0.410	0.510	0.0468	0.0399	0.2250	0.299
17	0.0371	0.0647	1.04	0.373	0.084	0.139	0.195	0.0150	0.0133	0.0552	0.127
18	0.0655	0.0957	2.42	0.576	0.107	0.198	0.330	0.0238	0.0226	0.1015	0.244
19	0.0197	0.0439	0.90	0.302	0.022	0.094	0.164	0.0104	0.0195	0.0427	0.097
20	0.0552	0.0823	1.86	0.441	0.071	0.129	0.220	0.0137	0.0229	0.0707	0.180
21	0.0424	0.0652	1.61	0.409	0.180	0.366	0.351	0.0391	0.0326	0.1421	0.244
22	0.0440	0.0697	1.50	0.326	0.089	0.122	0.155	0.0152	0.0208	0.0495	0.122
23	0.1030	0.1345	3.45	0.986	0.121	0.206	0.527	0.0436	0.0311	0.0158	0.513
24	0.0599	0.0850	2.23	0.551	0.112	0.146	0.274	0.0182	0.0285	0.0639	0.216
25	0.0787	0.1097	1.49	0.545	0.078	0.114	0.254	0.0093	0.0378	0.0497	0.167
26A	0.0437	0.0681	1.28	0.382	0.060	0.239	0.208	0.0088	0.0475	0.0304	0.144
27	0.0548	0.0822	1.80	0.441	0.090	0.111	0.288	0.0174	0.0148	0.0424	0.360
28											
29	0.0247	0.0469	1.49	0.306	0.440	0.598	0.191	0.1301	0.0336	0.3229	0.126
30A	0.0293	0.0560	1.23	0.332	0.080	0.126	0.258	0.0061	0.0182	0.0687	0.121
31	0.0215	0.0493	0.95	0.276	0.095	0.090	0.594	0.0051	0.0403	0.0500	0.185
32	0.0314	0.0594	1.17	0.387	0.083	0.085	0.367	0.0088	0.0139	0.0470	0.291
33	0.0298	0.0571	1.75	0.460	0.125	0.065	0.558	0.0176	0.0252	0.0327	0.474
34	0.0150	0.0483	1.07	0.383	0.110	0.126	0.620	0.0150	0.0300	0.0500	0.542
35	0.0268	0.0589	1.24	0.317	0.085	0.149	0.414	0.0050	0.0275	0.0987	0.206
36	0.0236	0.0553	1.02	0.280	0.121	0.201	0.278	0.0210	0.0641	0.0879	0.102

* CONCENTRATIONS ARE GEOMETERIC MEAN VALUES. NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 5(CONTINUED)

SEASON = WINTER 82/83

ID	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	0.0362	0.00995	0.001268	0.02832	0.1103	0.01502	0.00100	0.0930	0.00219	0.000200
2	0.0075	0.00613	0.000500	0.01158	0.1166	0.01061	0.00100	0.0914	0.00168	0.000178
3	0.0129	0.00962	0.000500	0.01058	0.1150	0.00915	0.00100	0.0856	0.00116	0.000221
4	0.0118	0.00325	0.000900	0.01332	0.0446	0.01019	0.00100	0.0646	0.00179	0.000217
5	0.0558	0.00247	0.001763	0.01790	0.0337	0.00666	0.00100	0.0331	0.00268	0.000220
6	0.0087	0.00271	0.000607	0.01141	0.0971	0.00843	0.00100	0.0317	0.00118	0.000479
7	0.0045	0.00259	0.000500	0.00676	0.0458	0.01062	0.00100	0.0352	0.00087	0.000087
8	0.0134	0.00504	0.001518	0.01344	0.1000	0.01107	0.00100	0.0712	0.00193	0.000200
9	0.0141	0.00277	0.000602	0.01263	0.0453	0.00886	0.00100	0.0477	0.00211	0.000179
10	0.0135	0.00904	0.000500	0.01157	0.0565	0.01113	0.00100	0.0356	0.00099	0.000150
11	0.0106	0.00248	0.000500	0.00612	0.0295	0.00760	0.00100	0.0204	0.00117	0.000100
12	0.0096	0.00147	0.000500	0.00405	0.0363	0.00623	0.00100	0.0291	0.00146	0.000060
13	0.0083	0.00101	0.001859	0.00745	0.0448	0.00642	0.00100	0.0176	0.00124	0.000061
15	0.0067	0.00156	0.000858	0.00447	0.0166	0.00720	0.00100	0.0168	0.00107	0.000050
16	0.0096	0.00737	0.000989	0.01037	0.0510	0.00767	0.00133	0.0396	0.00115	0.000050
17	0.0074	0.00100	0.000500	0.00321	0.0247	0.00617	0.00100	0.0148	0.00126	0.000050
18	0.0071	0.00149	0.000746	0.00458	0.0246	0.00556	0.00100	0.0153	0.00089	0.000173
19	0.0021	0.00050	0.000500	0.00398	0.0133	0.00382	0.00100	0.0122	0.00085	0.000908
20	0.0091	0.00089	0.000663	0.00374	0.0229	0.00498	0.00100	0.0159	0.00102	0.000164
21	0.0104	0.00180	0.000740	0.00649	0.0396	0.00865	0.00100	0.0291	0.00083	0.000200
22	0.0080	0.00172	0.000500	0.00357	0.0643	0.00255	0.00100	0.0494	0.00184	0.000050
23	0.0039	0.00173	0.000857	0.01022	0.0332	0.01089	0.00100	0.0291	0.00139	0.000199
24	0.0088	0.00248	0.000500	0.00674	0.0733	0.00927	0.00100	0.0557	0.00122	0.000200
25	0.0064	0.00123	0.000806	0.00617	0.0353	0.00498	0.00100	0.0269	0.00132	0.000177
26A	0.0078	0.00067	0.000500	0.00463	0.0193	0.00266	0.00100	0.0213	0.00111	0.000234
27	0.0041	0.00122	0.001445	0.00583	0.0474	0.00397	0.00100	0.0304	0.00502	0.000403
28										
29	0.0051	0.00154	0.000500	0.01556	0.0371	0.00554	0.00100	0.0131	0.00175	0.000209
30A	0.0086	0.00172	0.000500	0.00601	0.0357	0.00604	0.00100	0.0264	0.00173	0.000116
31	0.0105	0.00076	0.000500	0.00442	0.0123	0.00351	0.00100	0.0130	0.00099	0.000074
32	0.0043	0.00123	0.000500	0.00358	0.0169	0.00324	0.00100	0.0182	0.00161	0.000050
33	0.0055	0.00353	0.001259	0.00462	0.0426	0.00351	0.00100	0.0198	0.00131	0.000050
34	0.0070	0.00591	0.001999	0.01325	0.1360	0.00326	0.00100	0.0689	0.00295	0.000306
35	0.0154	0.00150	0.001125	0.00697	0.0465	0.00325	0.00100	0.0335	0.00237	0.000087
36	0.0088	0.00192	0.001925	0.01281	0.0428	0.00236	0.00100	0.0340	0.00245	0.000192

TABLE 6:

Seasonal Gauge Depth Weighted Mean Precipitation Concentration (mg/l)

SEASON = SPRING 83

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4
1	0.0551	0.0867	4.18	0.538	0.592	0.205	0.525	0.1231	0.0502	0.1011	0.444
2	0.0496	0.0810	4.71	0.618	0.958	0.265	0.670	0.1720	0.0691	0.1245	0.437
3	0.0497	0.0823	3.98	0.533	0.621	0.224	0.577	0.1048	0.0716	0.1102	0.420
4	0.0627	0.1354	5.43	0.646	0.893	0.242	0.707	0.1153	0.0776	0.1146	0.593
5	0.0424	0.0727	3.70	0.434	0.534	0.175	0.584	0.0927	0.0847	0.0805	0.432
6	0.0307	0.0473	3.52	0.482	0.658	0.144	0.553	0.1075	0.0384	0.0725	0.502
7	0.0380	0.0497	3.89	0.538	0.604	0.208	1.539	0.1593	0.0894	0.1039	1.048
8	0.0215	0.0447	3.58	0.513	0.635	0.156	0.937	0.1706	0.0628	0.0728	0.771
9	0.0432	0.1112	3.65	0.553	0.493	0.143	0.672	0.0790	0.0559	0.0617	0.565
10	0.0417	0.0465	4.14	0.600	0.911	0.244	0.505	0.3139	0.1152	0.0841	0.741
11	0.0258	0.0384	3.26	0.493	1.016	0.181	0.578	0.0818	0.0382	0.0887	0.381
12	0.0445	0.0608	3.08	0.479	0.413	0.161	0.448	0.0566	0.0510	0.0902	0.397
13	0.0255	0.0532	3.62	0.513	0.740	0.176	0.766	0.0628	0.0804	0.0854	0.581
15	0.0263	0.1045	2.08	0.307	0.367	0.095	0.305	0.0503	0.0320	0.0689	0.246
16	0.0326	0.0473	2.78	0.352	0.507	0.201	0.568	0.0580	0.0417	0.1222	0.418
17	0.0344	0.0482	2.31	0.317	0.258	0.107	0.319	0.0385	0.0387	0.0690	0.213
18	0.0430	0.0686	2.56	0.359	0.259	0.086	0.337	0.0384	0.0332	0.0529	0.274
19	0.0457	0.0681	2.40	0.268	0.173	0.065	0.297	0.0314	0.0248	0.0508	0.204
20	0.0472	0.0750	2.72	0.417	0.248	0.087	0.409	0.0348	0.0242	0.0492	0.271
21	0.0529	0.0864	3.33	0.499	0.263	0.124	0.434	0.0416	0.0424	0.0541	0.334
22	0.0377	0.0630	2.11	0.279	0.138	0.069	0.284	0.0244	0.0300	0.0282	0.172
23	0.0595	0.1100	3.22	0.511	0.231	0.108	0.445	0.0378	0.0371	0.0344	0.380
24	0.0422	0.0651	2.08	0.343	0.160	0.092	0.234	0.0211	0.0290	0.0442	0.141
25	0.0242	0.0471	1.34	0.146	0.072	0.063	0.132	0.0121	0.0296	0.0296	0.053
26A	0.0371	0.0637	2.02	0.238	0.115	0.074	0.217	0.0258	0.0281	0.0425	0.144
27	0.0485	0.0480	3.08	0.269	0.259	0.173	0.216	0.0696	0.0243	0.0846	0.146
28	.	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	.	.	.
30A	0.0028	0.0216	3.69	0.438	0.360	0.217	0.545	0.0511	0.0295	0.1432	0.367
31	0.0522	0.1105	3.36	0.411	0.271	0.104	0.500	0.0403	0.0393	0.0600	0.349
32	0.0220	0.0483	2.78	0.428	0.315	0.145	0.666	0.0601	0.0493	0.0501	0.471
33	0.0095	0.0305	2.31	0.307	0.776	0.101	0.321	0.1041	0.0526	0.0700	0.143
34	0.0206	0.0381	2.64	0.443	0.481	0.151	0.768	0.0684	0.0606	0.0976	0.641
35	0.0244	0.0473	2.55	0.361	0.327	0.137	0.541	0.0442	0.0450	0.0765	0.446
36	0.0437	0.0469	3.10	0.346	0.270	0.210	0.773	0.0450	0.0350	0.1000	0.373

* CONCENTRATIONS ARE GEOMETERIC MEAN VALUES. NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 6(CONTINUED)

SEASON = SPRING 83

ID	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	0.0113	0.00672	0.000591	0.00965	0.0983	0.00569	0.00100	0.1129	0.00138	0.000091
2	0.0367	0.00768	0.000500	0.00887	0.1288	0.00683	0.00100	0.1392	0.00115	0.000220
3	0.0279	0.00646	0.000500	0.00572	0.0855	0.00507	0.00100	0.1071	0.00118	0.000131
4	0.0164	0.00710	0.000579	0.00884	0.1169	0.00707	0.00100	0.0934	0.00205	0.000205
5	0.0240	0.00539	0.000500	0.00679	0.0947	0.00440	0.00100	0.1351	0.00296	0.000138
6	0.0108	0.00556	0.000720	0.00659	0.0942	0.00697	0.00100	0.0851	0.00172	0.000255
7	0.0507	0.00614	0.000500	0.00648	0.0611	0.00591	0.00100	0.0623	0.00148	0.000090
8	0.0417	0.00573	0.000500	0.00873	0.0597	0.00355	0.00100	0.0687	0.00125	0.000200
9	0.0279	0.00506	0.000500	0.00555	0.0556	0.00625	0.00100	0.0708	0.00121	0.000154
10	0.0184	0.00731	0.000500	0.01514	0.1151	0.00573	0.00100	0.1562	0.00629	0.000050
11	0.0389	0.00558	0.000500	0.00690	0.0694	0.00481	0.00100	0.0888	0.00098	0.000307
12	0.0703	0.00387	0.000500	0.00517	0.0505	0.00654	0.00100	0.0387	0.00123	0.000653
13	0.0410	0.00498	0.000823	0.00593	0.1227	0.00734	0.00100	0.1165	0.00371	0.000179
15	0.0078	0.00350	0.000500	0.00402	0.0469	0.00513	0.00100	0.0422	0.00112	0.000082
16	0.0112	0.00681	0.000655	0.00799	0.0506	0.00458	0.00158	0.0362	0.00100	0.000050
17	0.0081	0.00351	0.000500	0.00349	0.0460	0.00393	0.00100	0.0498	0.00224	0.000050
18	0.0129	0.00319	0.000500	0.00298	0.0590	0.00485	0.00100	0.0722	0.00097	0.000050
19	0.0058	0.00228	0.000576	0.00596	0.0366	0.00465	0.00100	0.0329	0.00214	0.000115
20	0.0037	0.00239	0.000500	0.00589	0.0298	0.00976	0.00100	0.0288	0.00112	0.000071
21	0.0150	0.00336	0.000500	0.00456	0.0355	0.00458	0.00100	0.0387	0.00179	0.000050
22	0.0106	0.00200	0.000500	0.00279	0.0485	0.00169	0.00100	0.0458	0.00218	0.000077
23	0.0089	0.00258	0.000644	0.00877	0.0399	0.00332	0.00100	0.0440	0.00115	0.000050
24	0.0126	0.00190	0.000500	0.00363	0.0251	0.00390	0.00100	0.0353	0.00085	0.000050
25	0.0065	0.00071	0.000500	0.00682	0.0263	0.00196	0.00100	0.0240	0.00262	0.000050
26A	0.0064	0.00100	0.000500	0.00773	0.0213	0.00283	0.00100	0.0227	0.00156	0.000066
27	0.0016	0.00268	0.001080	0.00563	0.0401	0.00214	0.00100	0.0330	0.00341	0.000110
28	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	.	.
30A	0.0186	0.00289	0.000784	0.00717	0.0880	0.00616	0.00100	0.0992	0.00241	0.000192
31	0.0142	0.00373	0.000500	0.00639	0.0822	0.00654	0.00100	0.0525	0.00148	0.000113
32	0.0121	0.00824	0.000500	0.00718	0.0781	0.00401	0.00100	0.0643	0.00265	0.000093
33	0.0112	0.04610	0.000903	0.00666	0.1572	0.00461	0.00100	0.1040	0.00162	0.000090
34	0.0155	0.00578	0.000500	0.00615	0.0676	0.00261	0.00100	0.0888	0.00470	0.000138
35	0.0167	0.00454	0.000500	0.00497	0.0773	0.00212	0.00100	0.0808	0.00386	0.000123
36	0.0364	0.00577	0.001030	0.00966	0.0770	0.00428	0.00100	0.0594	0.00380	0.000282

TABLE 7:

Seasonal Gauge Depth Weighted Mean Precipitation Concentration (mg/l)

SEASON = SUMMER 83

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4
1	0.0569	0.0974	5.52	0.572	0.531	0.161	0.839	0.1186	0.0596	0.0374	0.716
2	0.0468	0.0831	5.40	0.602	0.945	0.193	0.528	0.1746	0.0782	0.0851	0.584
3	0.0702	0.1190	5.58	0.599	0.398	0.160	0.587	0.0696	0.0443	0.0238	0.586
4	0.0746	0.0703	6.20	0.763	0.700	0.214	0.807	0.1033	0.0773	0.0700	0.735
5	0.0526	0.0876	4.92	0.590	0.589	0.244	0.659	0.1041	0.1284	0.1120	0.591
6	0.0558	0.0967	5.69	0.617	0.695	0.152	0.902	0.1113	0.0370	0.0383	0.785
7	0.0454	0.0723	4.10	0.467	0.410	0.146	0.550	0.0785	0.0485	0.0434	0.486
8	0.0307	0.0590	4.19	0.490	0.674	0.124	0.801	0.1419	0.0604	0.0979	0.671
9	0.0585	0.0961	4.72	0.632	0.458	0.143	0.659	0.0970	0.0452	0.0404	0.607
10	0.0132	0.0303	5.79	0.601	1.133	0.239	0.878	0.3900	0.0558	0.0619	0.695
11	0.0317	0.0554	6.35	0.840	1.661	0.281	1.107	0.1614	0.0636	0.0649	0.866
12	.	0.0313	4.20	0.516	0.475	0.282	0.638	0.1877	0.1975	0.1026	1.315
13	0.0148	0.0339	5.62	0.712	1.130	0.148	0.934	0.1284	0.1022	0.0409	0.708
15	0.0589	0.0732	6.47	0.719	1.014	0.165	0.969	.	0.0650	0.0582	0.626
16	0.0473	0.0623	4.07	0.528	0.564	0.160	1.276	0.0810	0.0745	0.0404	0.944
17	0.0518	0.0872	4.27	0.471	0.346	0.109	0.622	0.0629	0.0787	0.0417	0.517
18	0.0611	0.0986	4.38	0.488	0.328	0.096	0.474	0.0573	0.0406	0.0285	0.432
19	0.0540	0.0867	4.30	0.426	0.297	0.108	0.629	0.0500	0.0834	0.0220	0.535
20	0.0520	0.0832	3.97	0.506	0.393	0.102	0.595	0.0666	0.0439	0.0473	0.451
21	0.0731	0.1061	5.64	0.636	0.509	0.150	0.803	0.0932	0.0632	0.0492	0.693
22	0.0475	0.0814	3.58	0.314	0.246	0.097	0.502	0.0349	0.0451	0.0414	0.364
23	0.0516	0.0858	4.46	0.492	0.356	0.118	0.974	0.0561	0.0769	0.0439	0.543
24	0.0373	0.0671	3.86	0.296	0.225	0.099	0.767	0.0412	0.1681	0.0806	0.571
25	0.0201	0.0436	1.99	0.190	0.183	0.230	0.446	0.0310	0.0525	0.1430	0.318
26	0.0159	0.0387	1.75	0.273	0.212	0.115	0.401	0.0223	0.0567	0.0560	0.351
26A	0.0425	0.0666	3.00	0.277	0.169	0.091	0.419	0.0350	0.0710	0.0444	0.331
27	0.0165	0.0691	1.61	0.173	0.195	0.041	0.272	0.0275	0.0439	0.0324	0.222
28	.	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	.	.	.
30	0.0069	0.0184	1.10	0.250	0.220	0.040	0.410	0.0250	0.0350	0.0300	0.314
30A	0.0123	0.0621	1.41	0.208	0.191	0.074	0.348	0.0250	0.0313	0.0200	0.261
31	0.0061	0.0239	1.19	0.191	0.244	0.070	0.449	0.0329	0.0443	0.0493	0.298
32	0.0063	0.0240	1.02	0.161	0.187	0.036	0.307	0.0252	0.0551	0.0321	0.277
33	0.0045	0.0219	0.82	0.199	0.173	0.019	0.392	0.0290	0.0496	0.0152	0.276
34	0.0016	0.0202	0.80	0.213	0.268	0.018	0.400	0.0637	0.0972	0.0247	0.282
35	0.0071	0.0229	0.91	0.196	0.183	0.035	0.350	0.0580	0.0910	0.0095	0.229
36	0.0059	0.0220	0.84	0.166	0.228	0.034	0.279	0.0457	0.0680	0.0148	0.174

* CONCENTRATIONS ARE GEOMETERIC MEAN VALUES. NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 7(CONTINUED)

SEASON = SUMMER 83

ID	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	0.0162	0.00422	0.001195	0.00776	0.0546	0.00774	0.00100	0.0647	0.00082	0.000110
2	0.0063	0.00622	0.001779	0.00635	0.0744	0.00649	0.00100	0.0882	0.00109	0.000094
3	0.0094	0.00408	0.000687	0.00579	0.0454	0.00763	0.00100	0.0633	0.00086	0.000087
4	0.0098	0.00481	0.001178	0.01004	0.0601	0.00771	0.00100	0.0651	0.00137	0.000125
5	0.0099	0.00495	0.001999	0.01445	0.0527	0.00800	0.00100	0.0671	0.00321	0.000428
6	0.0172	0.00474	0.000500	0.01006	0.0591	0.00861	0.00100	0.0735	0.00092	0.000094
7	0.0085	0.00376	0.000920	0.00418	0.0437	0.00542	0.00100	0.0723	0.00094	0.000050
8	0.0196	0.00409	0.000500	0.00487	0.0421	0.00336	0.00100	0.0503	0.00124	0.000050
9	0.0116	0.00417	0.000885	0.00568	0.0465	0.00641	0.00100	0.0552	0.00105	0.000062
10	0.0150	0.00784	0.000590	0.00765	0.0913	0.00800	0.00100	0.0680	0.00128	0.000050
11	0.0217	0.00668	0.000565	0.00750	0.1005	0.00708	0.00100	0.0663	0.00224	0.000069
12	0.0930	0.00675	0.001149	0.01313	0.0501	0.00498	0.00100	0.0449	0.00196	0.000115
13	0.0350	0.00783	0.000847	0.00709	0.0969	0.00814	0.00100	0.1070	0.00394	0.000100
15	0.0150	0.00897	0.000918	0.00797	0.0762	0.00820	0.00100	0.0820	0.00183	0.000091
16	0.0325	0.00662	0.000637	0.00851	0.0658	0.00750	0.00100	0.0813	0.00247	0.000161
17	0.0123	0.00404	0.000580	0.00458	0.0491	0.00537	0.00100	0.0472	0.00150	0.000094
18	0.0065	0.00328	0.000500	0.00455	0.0384	0.00638	0.00100	0.0485	0.00131	0.000079
19	0.0169	0.00393	0.000646	0.00472	0.0306	0.00894	0.00100	0.0426	0.00102	0.000100
20	0.0156	0.00472	0.000500	0.00383	0.0572	0.00503	0.00100	0.0674	0.00109	0.000073
21	0.0149	0.00589	0.000500	0.00851	0.0664	0.00632	0.00100	0.0577	0.00175	0.000068
22	0.0163	0.00399	0.000500	0.00459	0.0844	0.00402	0.00100	0.0699	0.00135	0.000107
23	0.0273	0.00401	0.000500	0.00728	0.0427	0.00498	0.00100	0.0388	0.00199	0.000100
24	0.0382	0.00400	0.000500	0.00822	0.0394	0.00925	0.00100	0.0283	0.00184	0.000144
25	0.0232	0.00294	0.000553	0.00564	0.0346	0.00376	0.00100	0.0337	0.00109	0.000074
26	0.0040	0.00346	0.000500	0.00352	0.0433	0.00200	0.00100	0.0334	0.00137	0.000050
26A	0.0100	0.00272	0.000500	0.00642	0.0325	0.00274	0.00100	0.0322	0.00141	0.000146
27	0.0064	0.00215	0.000500	0.00273	0.0251	0.00638	0.00100	0.0233	0.00127	0.000050
28										
29										
30	0.0070	0.00200	0.000500	0.00127	0.0119	0.00050	0.00100	0.0210	0.00077	0.000050
30A	0.0038	0.00337	0.000500	0.00180	0.0505	0.00300	0.00100	0.0386	0.00090	0.000050
31	0.0151	0.00269	0.000500	0.00277	0.0312	0.00100	0.00100	0.0311	0.00085	0.000059
32	0.0053	0.00315	0.000500	0.00240	0.0279	0.00185	0.00100	0.0318	0.00080	0.000050
33	0.0157	0.00348	0.001092	0.00176	0.0729	0.00367	0.00100	0.0454	0.00078	0.000066
34	0.0067	0.00425	0.000629	0.00426	0.0484	0.00150	0.00100	0.0497	0.00125	0.000050
35	0.0248	0.00382	0.000645	0.00251	0.0616	0.00131	0.00100	0.0591	0.00105	0.000050
36	0.0193	0.00373	0.000865	0.00231	0.0463	0.00232	0.00100	0.0417	0.00207	0.000052

TABLE 8:

Seasonal Gauge Depth Weighted Mean Precipitation Concentration (mg/l)

SEASON = AUTUHN 83

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4
1	0.0499	0.0746	3.09	0.371	0.251	0.163	0.297	0.0583	0.0199	0.0301	0.249
2	0.0412	0.0624	3.25	0.497	0.507	0.161	0.361	0.1006	0.0297	0.0387	0.274
3	0.0323	0.0420	2.82	0.417	0.594	0.235	0.741	0.1289	0.0800	0.0487	0.418
4	0.0503	0.0733	3.40	0.438	0.416	0.126	0.364	0.0522	0.0212	0.0441	0.311
5	0.0331	0.0572	2.57	0.369	0.294	0.146	0.234	0.0541	0.0204	0.0350	0.197
6	0.0199	0.0445	3.75	0.470	0.812	0.071	0.631	0.1353	0.0350	0.0310	0.524
7	0.0316	0.0588	2.77	0.391	0.268	0.101	0.463	0.0618	0.0415	0.0509	0.323
8	0.0262	0.0515	3.04	0.437	0.379	0.059	0.519	0.0871	0.0327	0.0338	0.446
9	0.0308	0.0557	2.46	0.401	0.245	0.051	0.402	0.0522	0.0213	0.0262	0.329
10	0.0608	0.0491	3.78	0.516	1.215	0.218	0.515	0.2500	0.0407	0.0695	0.418
11	0.0334	0.0586	2.69	0.446	0.347	0.101	0.423	0.0455	0.0268	0.0252	0.304
12	0.0413	0.0536	2.53	0.491	0.246	0.104	0.358	0.0307	0.0279	0.0365	0.284
13	0.0312	0.0555	2.26	0.435	0.305	0.134	0.487	0.0310	0.0477	0.0433	0.311
15	0.0155	0.0379	2.05	0.350	0.379	0.097	0.228	0.1357	0.0145	0.0639	0.178
16	0.0234	0.0508	2.34	0.378	0.347	0.090	0.703	0.0456	0.0622	0.0933	0.339
17	0.0300	0.0556	2.08	0.359	0.178	0.082	0.310	0.0260	0.0331	0.0501	0.239
18	0.0416	0.0522	2.28	0.472	0.138	0.083	0.306	0.0211	0.0250	0.0253	0.275
19	0.0364	0.0636	2.17	0.352	0.088	0.036	0.241	0.0184	0.0191	0.0347	0.192
20	0.0429	0.0540	2.01	0.386	0.133	0.059	0.337	0.0207	0.0190	0.0241	0.332
21	0.0265	0.0503	1.91	0.305	0.142	0.049	0.270	0.0289	0.0258	0.0312	0.225
22	0.0315	0.0388	2.76	0.265	0.103	0.089	0.234	0.0100	0.0275	0.0520	0.133
23	0.0421	0.0641	2.51	0.405	0.207	0.052	0.313	0.0287	0.0334	0.0273	0.282
24	0.0794	0.0853	3.59	0.677	0.246	0.360	1.120	0.0500	0.2950	0.1200	0.324
25	0.0262	0.0463	1.42	0.221	0.087	0.032	0.188	0.0150	0.0250	0.0184	0.156
26	0.0199	0.0412	2.15	0.347	0.080	0.064	0.242	0.0515	0.0831	0.0374	0.199
27	0.0247	0.0448	1.64	0.177	0.148	0.121	0.136	0.0288	0.0428	0.0864	0.111
28	.	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	.	.	.
30	0.0184	0.0359	1.34	0.146	0.099	0.054	0.246	0.0170	0.0323	0.0444	0.160
31	0.0255	0.0429	1.14	0.195	0.089	0.043	0.120	0.0131	0.0123	0.0351	0.035
32	0.0106	0.0286	1.08	0.184	0.180	0.022	0.187	0.0357	0.0483	0.0438	0.129
33	0.0177	0.0367	1.36	0.226	0.164	0.032	0.222	0.0240	0.0319	0.0370	0.146
34	0.0098	0.0296	1.16	0.182	0.119	0.042	0.260	0.0161	0.0244	0.0400	0.222
35	0.0179	0.0289	1.42	0.242	0.099	0.081	0.158	0.0540	0.0347	0.0789	0.219
36	0.0041	0.0211	0.46	0.067	0.067	0.073	0.094	0.0149	0.0230	0.0563	0.061
37	0.0312	0.0520	2.05	0.290	0.127	0.087	0.326	0.0208	0.0194	0.0280	0.271

* CONCENTRATIONS ARE GEOMETERIC MEAN VALUES. NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 8(CONTINUED)

SEASON = AUTUMN 83

ID	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	0.0051	0.00307	0.000500	0.02264	0.0511	0.00573	0.00100	0.0609	0.00082	0.000218
2	0.0086	0.00321	0.001815	0.00724	0.0500	0.00499	0.00100	0.0541	0.00114	0.000138
3	0.0331	0.00402	0.001129	0.00820	0.0648	0.00552	0.00100	0.0581	0.00116	0.000155
4	0.0035	0.00352	0.000902	0.00923	0.0830	0.00709	0.00100	0.0865	0.00104	0.000143
5	0.0048	0.00257	0.000500	0.00651	0.0412	0.00844	0.00100	0.0437	0.00093	0.000181
6	0.0125	0.00722	0.000760	0.01094	0.1960	0.01270	0.00100	0.1745	0.00110	0.000089
7	0.0118	0.00261	0.000500	0.00671	0.0385	0.00628	0.00100	0.0348	0.00110	0.000058
8	0.0077	0.00367	0.000500	0.00685	0.0603	0.00477	0.00100	0.0599	0.00107	0.000114
9	0.0061	0.00252	0.000500	0.00450	0.0407	0.00397	0.00100	0.0426	0.00074	0.000055
10	0.0084	0.00580	0.000500	0.00804	0.0280	0.00523	0.00100	0.0190	0.00083	0.000055
11	0.0075	0.00236	0.000500	0.00454	0.0233	0.00409	0.00100	0.0251	0.00113	0.000150
12	0.0097	0.00234	0.000500	0.00568	0.0290	0.00350	0.00100	0.0211	0.00081	0.000050
13	0.0226	0.00198	0.000500	0.00484	0.0364	0.00637	0.00100	0.0332	0.00077	0.000050
15	0.0025	0.00392	0.000500	0.00532	0.0597	0.00520	0.00100	0.0534	0.00086	0.000102
16	0.0237	0.00355	0.000500	0.00856	0.0260	0.00480	0.00100	0.0270	0.00100	0.000078
17	0.0093	0.00287	0.000500	0.00781	0.0518	0.00662	0.00100	0.0518	0.00168	0.000110
18	0.0069	0.00176	0.000500	0.00438	0.0174	0.00499	0.00100	0.0197	0.00076	0.000065
19	0.0062	0.00127	0.000500	0.00556	0.0334	0.00320	0.00100	0.0322	0.00069	0.000060
20	0.0055	0.00086	0.000500	0.00282	0.0101	0.00400	0.00100	0.0124	0.00071	0.000050
21	0.0038	0.00151	0.000734	0.00306	0.0503	0.00430	0.00100	0.0502	0.00072	0.000073
22	0.0610	0.00879	0.005141	0.00267	0.0393	0.01055	0.00100	0.1353	0.00117	0.000050
23	0.0064	0.00239	0.000500	0.00632	0.0536	0.00499	0.00100	0.0559	0.00087	0.000062
24	0.0610	0.00418	0.001729	0.02818	0.0550	0.01337	0.00100	0.0562	0.00727	0.000710
25	0.0067	0.00100	0.000500	0.00431	0.0326	0.00534	0.00100	0.0480	0.00103	0.000117
26	0.0345	0.00300	0.000500	0.00650	0.0205	0.00250	0.00100	0.0408	0.00201	0.000066
27	0.0083	0.00166	0.000500	0.00253	0.0267	0.00195	0.00100	0.0352	0.00097	0.000085
28	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	.	.
30	0.0137	0.00093	0.000500	0.00330	0.0118	0.00181	0.00100	0.0203	0.00179	0.000093
31	0.0077	0.00093	0.000500	0.00246	0.0137	0.00172	0.00100	0.0221	0.00093	0.000064
32	0.0067	0.00257	0.001309	0.00338	0.0383	0.00073	0.00100	0.0485	0.00078	0.000050
33	0.0073	0.00200	0.001105	0.00398	0.0611	0.00221	0.00100	0.0802	0.00142	0.000300
34	0.0095	0.00205	0.000500	0.00409	0.0675	0.00283	0.00100	0.0819	0.00105	0.000050
35	0.0262	0.00355	0.000500	0.00772	0.0853	0.00382	0.00100	0.0972	0.00227	0.000229
36	0.0051	0.00157	0.000500	0.00152	0.0252	0.00092	0.00100	0.0336	0.00076	0.000075
37	0.0102	0.00207	0.000500	0.00332	0.0233	0.00331	0.00100	0.0273	0.00073	0.000069

TABLE 9:

Seasonal Wet Deposition (mg/m^2) - Winter 82/83

SEASON = WINTER 82/83

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	HG	K	NA	N_NH4	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	10.6	15.4	602	131.8	55.2	.	65.2	31.6	6.8	.	64.0	4.3	1.17	0.1	3.34	13.0	1.77	0.118	11.0	0.26	0.024
2	4.3	8.1	464	87.7	104.5	55.8	68.0	26.1	4.7	29.7	44.9	0.9	0.73	0.1	1.38	13.9	1.26	0.119	10.9	0.20	0.021
3	13.4	18.5	543	99.9	143.4	49.8	66.0	28.5	6.5	23.6	51.9	1.7	1.26	0.1	1.39	15.1	1.20	0.131	11.2	0.15	0.029
4	7.9	13.4	516	92.5	98.9	52.5	93.2	11.6	7.3	20.7	75.9	1.4	0.37	0.1	1.53	5.1	1.17	0.115	7.4	0.21	0.025
5	9.7	15.9	445	90.2	52.2	53.4	63.5	11.4	13.4	22.7	50.4	8.6	0.38	0.3	2.76	5.2	1.02	0.154	5.1	0.41	0.034
6	6.1	8.8	417	81.0	64.7	39.6	63.4	20.1	3.8	16.7	56.1	1.2	0.38	0.1	1.60	13.6	1.18	0.140	4.4	0.17	0.067
7	8.4	13.8	391	91.2	51.9	46.3	67.1	14.5	2.8	18.4	57.9	0.8	0.44	0.1	1.15	7.8	1.81	0.170	6.0	0.15	0.015
8	4.2	7.8	380	90.4	93.4	36.1	73.8	33.5	3.3	17.4	68.4	1.4	0.54	0.2	1.45	10.8	1.20	0.108	7.7	0.21	0.022
9	14.5	20.5	598	143.3	51.3	50.9	109.0	12.4	4.5	25.6	95.3	2.5	0.49	0.1	2.25	8.1	1.58	0.178	8.5	0.38	0.032
10	4.2	7.2	611	89.8	181.3	115.4	89.3	77.9	4.8	61.9	59.8	2.1	1.44	0.1	1.84	9.0	1.77	0.159	5.7	0.16	0.024
11	8.6	12.8	389	83.9	50.8	39.6	68.5	4.7	1.7	21.2	41.9	1.6	0.37	0.1	0.92	4.4	1.14	0.150	3.1	0.18	0.015
12	7.8	13.4	268	71.2	27.2	34.4	45.3	5.2	5.0	16.1	37.0	1.8	0.27	0.1	0.75	6.7	1.15	0.185	5.4	0.27	0.011
13	6.1	10.9	228	53.8	29.4	27.2	57.2	3.3	3.3	12.2	29.1	1.5	0.18	0.3	1.36	8.1	1.17	0.182	3.2	0.23	0.011
15	6.0	10.3	238	53.8	20.9	28.7	35.0	5.8	2.3	14.0	29.9	1.1	0.26	0.1	0.75	2.8	1.21	0.168	2.8	0.18	0.008
16	4.5	10.4	398	80.8	123.2	81.9	102.0	9.3	8.0	45.0	59.8	1.9	1.47	0.2	2.07	10.2	1.53	0.265	7.9	0.23	0.010
17	5.3	9.2	148	52.8	11.9	19.6	27.6	2.1	1.9	7.8	18.0	1.1	0.14	0.1	0.45	3.5	0.87	0.141	2.1	0.18	0.007
18	12.5	18.3	462	110.1	20.4	37.9	63.1	4.5	4.3	19.4	46.6	1.4	0.28	0.1	0.87	4.7	1.06	0.191	2.9	0.17	0.033
19	3.1	6.9	140	47.1	3.4	14.6	25.5	1.6	3.0	6.7	15.2	0.3	0.08	0.1	0.62	2.1	0.60	0.156	1.9	0.13	0.142
20	11.2	16.7	378	89.6	14.3	26.1	44.6	2.8	4.6	14.3	36.6	1.9	0.18	0.1	0.76	4.6	1.01	0.203	3.2	0.21	0.033
21	9.9	15.2	375	95.4	42.0	85.4	82.0	9.1	7.6	33.2	56.9	2.4	0.42	0.2	1.51	9.2	2.02	0.233	6.8	0.19	0.047
22	7.0	11.1	240	52.1	14.2	19.5	24.8	2.4	3.3	7.9	19.5	1.3	0.28	0.1	0.57	10.3	0.41	0.160	7.9	0.29	0.008
23	15.9	20.8	532	152.4	18.7	31.8	81.4	6.7	4.8	2.4	79.3	0.6	0.27	0.1	1.58	5.1	1.68	0.154	4.5	0.22	0.031
24	7.5	10.7	281	69.3	14.1	18.3	34.4	2.3	3.6	8.0	27.2	1.1	0.31	0.1	0.85	9.2	1.17	0.126	7.0	0.15	0.025
25	10.1	14.0	191	69.6	10.0	14.5	32.5	1.2	4.8	6.3	21.4	0.8	0.16	0.1	0.79	4.5	0.64	0.128	3.4	0.17	0.023
26A	6.6	10.2	193	57.2	9.0	35.9	31.2	1.3	7.1	4.6	21.6	1.2	0.10	0.1	0.70	2.9	0.40	0.150	3.2	0.17	0.035
27	5.0	7.5	165	40.3	8.2	10.1	26.3	1.6	1.3	3.9	32.9	0.4	0.11	0.1	0.53	4.3	0.36	0.091	2.8	0.46	0.037
28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	1.2	2.3	73	15.0	21.6	29.3	9.4	6.4	1.6	15.8	6.2	0.2	0.08	0.0	0.76	1.8	0.27	0.049	0.6	0.09	0.010
30A	1.9	3.6	80	21.6	5.2	8.2	16.8	0.4	1.2	4.5	7.9	0.6	0.11	0.0	0.39	2.3	0.39	0.065	1.7	0.11	0.008
31	1.7	3.9	76	21.9	7.6	7.2	47.2	0.4	3.2	4.0	14.7	0.8	0.06	0.0	0.35	1.0	0.28	0.079	1.0	0.08	0.006
32	3.1	5.9	115	38.2	8.2	8.4	36.2	0.9	1.4	4.6	28.6	0.4	0.12	0.0	0.35	1.7	0.32	0.098	1.8	0.16	0.005
33	2.3	4.4	136	35.7	9.7	5.1	43.3	1.4	2.0	2.5	36.8	0.4	0.27	0.1	0.36	3.3	0.27	0.077	1.5	0.10	0.004
34	0.9	2.9	64	23.0	6.6	7.5	37.2	0.9	1.8	3.0	32.5	0.4	0.35	0.1	0.80	8.2	0.20	0.060	4.1	0.18	0.018
35	1.2	2.7	57	14.5	3.9	6.8	18.9	0.2	1.3	4.5	9.4	0.7	0.07	0.1	0.32	2.1	0.15	0.046	1.5	0.11	0.004
36	1.5	3.6	66	18.2	7.9	13.1	18.1	1.4	4.2	5.7	6.7	0.6	0.13	0.1	0.83	2.8	0.15	0.065	2.2	0.16	0.013

* NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 10:

Seasonal Wet Deposition (mg/m^2) - Spring 1983.

SEASON = SPRING 83

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	14.0	22.0	1061	136.7	150.3	52.1	133.4	31.3	12.8	25.7	112.7	2.9	1.71	0.1	2.45	25.0	1.44	0.254	28.7	0.35	0.023
2	11.0	17.9	1041	136.5	211.8	58.6	148.1	38.0	15.3	27.5	96.5	8.1	1.70	0.1	1.96	28.5	1.51	0.221	30.8	0.25	0.049
3	12.2	20.2	979	131.0	152.5	55.0	141.9	25.8	17.6	27.1	103.2	6.9	1.59	0.1	1.41	21.0	1.25	0.246	26.3	0.29	0.032
4	15.1	32.7	1310	155.9	215.5	58.5	170.5	27.8	18.7	27.6	143.2	4.0	1.71	0.1	2.13	28.2	1.71	0.241	22.5	0.50	0.049
5	13.6	23.3	1184	138.9	170.9	55.9	187.0	29.7	27.1	25.8	138.3	7.7	1.73	0.2	2.17	30.3	1.41	0.320	43.2	0.95	0.044
6	7.1	10.9	814	111.4	152.3	33.4	128.0	24.9	8.9	16.8	116.2	2.5	1.29	0.2	1.53	21.8	1.61	0.231	19.7	0.40	0.059
7	10.0	13.0	1019	140.8	158.1	54.5	403.0	41.7	23.4	27.2	274.4	13.3	1.61	0.1	1.70	16.0	1.55	0.262	16.3	0.39	0.024
8	5.1	10.5	844	121.0	149.8	36.9	221.1	40.3	14.8	17.2	182.0	9.8	1.35	0.1	2.06	14.1	0.84	0.256	16.2	0.29	0.047
9	12.2	31.5	1033	156.4	139.3	40.6	190.2	22.3	15.8	17.5	159.9	7.9	1.43	0.1	1.57	15.7	1.77	0.283	20.0	0.34	0.044
10	8.2	9.1	811	117.6	178.6	47.8	99.0	61.5	22.6	16.5	145.1	3.6	1.43	0.1	2.97	22.6	1.12	0.196	30.6	1.23	0.010
11	5.4	8.0	677	102.6	211.2	37.7	120.3	17.0	7.9	18.5	79.2	8.1	1.16	0.1	1.43	14.4	1.00	0.208	18.5	0.20	0.064
12	7.3	11.3	504	78.3	67.6	26.4	73.3	9.3	8.3	14.8	65.0	3.3	0.63	0.1	0.85	8.3	1.07	0.164	6.3	0.20	0.107
13	5.8	12.0	816	115.6	166.8	39.7	172.5	14.1	18.1	19.2	130.8	9.2	1.12	0.2	1.34	27.6	1.65	0.225	26.2	0.83	0.040
15	5.1	20.2	403	59.4	70.9	18.4	58.9	9.7	6.2	13.3	47.5	1.5	0.68	0.1	0.93	9.1	0.99	0.193	8.2	0.22	0.016
16	8.7	12.7	746	94.6	136.1	54.1	152.5	15.6	11.2	32.8	112.3	3.0	1.83	0.2	2.15	13.6	1.23	0.424	9.7	0.27	0.013
17	8.3	11.6	555	76.3	61.9	25.7	76.5	9.2	9.3	16.6	51.2	1.9	0.84	0.1	0.84	11.0	0.94	0.240	12.0	0.54	0.012
18	13.1	20.9	782	109.6	78.9	26.2	102.7	11.7	10.1	16.1	83.6	3.9	0.97	0.2	0.91	18.0	1.48	0.305	22.0	0.30	0.015
19	13.0	19.3	683	76.0	49.2	18.4	84.4	8.9	7.0	14.4	58.1	1.7	0.65	0.2	1.69	10.4	1.32	0.284	9.3	0.61	0.033
20	13.3	21.2	769	117.9	70.1	24.7	115.9	9.9	6.9	13.9	76.7	1.0	0.67	0.1	1.67	8.4	2.76	0.283	8.1	0.32	0.020
21	16.4	26.8	1033	154.7	81.6	38.4	134.4	12.9	13.2	16.8	103.4	4.6	1.04	0.2	1.41	11.0	1.42	0.310	12.0	0.56	0.015
22	9.2	15.4	516	68.1	33.6	16.8	69.3	5.9	7.3	6.9	41.9	2.6	0.49	0.1	0.68	11.8	0.41	0.244	11.2	0.53	0.019
23	17.4	32.3	945	149.8	67.6	31.7	130.3	11.1	10.9	10.1	111.4	2.6	0.76	0.2	2.57	11.7	0.97	0.293	12.9	0.34	0.015
24	3.5	5.4	174	28.6	13.3	7.6	19.5	1.8	2.4	3.7	11.7	1.1	0.16	0.0	0.30	2.1	0.32	0.083	2.9	0.07	0.004
25	4.0	7.8	221	24.1	11.8	10.5	21.8	2.0	4.9	4.9	8.8	1.1	0.12	0.1	1.13	4.8	0.32	0.165	4.0	0.43	0.008
26A	7.8	13.4	422	49.8	24.2	15.6	45.4	5.4	5.9	8.9	30.1	1.3	0.21	0.1	1.62	4.5	0.59	0.209	4.7	0.33	0.014
27	5.3	5.2	336	29.2	28.1	18.8	23.5	7.6	2.6	9.2	15.8	0.2	0.29	0.1	0.61	4.4	0.23	0.109	3.6	0.37	0.012
28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30A	0.2	1.8	312	37.0	30.4	18.3	46.0	4.3	2.5	12.1	31.0	1.6	0.24	0.1	0.61	7.4	0.52	0.084	8.4	0.20	0.016
31	6.8	14.3	435	53.3	35.1	13.4	64.8	5.2	5.1	7.8	45.2	1.8	0.48	0.1	0.83	10.7	0.85	0.130	6.8	0.19	0.015
32	1.9	4.2	243	37.4	27.5	12.7	58.2	5.3	4.3	4.4	41.1	1.1	0.72	0.0	0.63	6.8	0.35	0.087	5.6	0.23	0.008
33	0.6	1.8	136	18.1	45.6	5.9	18.9	6.1	3.1	4.1	8.4	0.7	2.71	0.1	0.39	9.2	0.27	0.059	6.1	0.10	0.005
34	1.7	3.2	222	37.3	40.5	12.7	64.7	5.8	5.1	8.2	54.1	1.3	0.49	0.0	0.52	5.7	0.22	0.084	7.5	0.40	0.012
35	2.7	5.3	286	40.4	36.7	15.3	60.6	4.9	5.0	8.6	50.0	1.9	0.51	0.1	0.56	8.7	0.24	0.112	9.1	0.43	0.014
36	3.1	3.3	218	24.3	19.0	14.8	54.3	3.2	2.5	7.0	26.2	2.6	0.41	0.1	0.68	5.4	0.30	0.070	4.2	0.27	0.020

* NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 11:

Seasonal Wet Deposition (mg/m^2) - Summer 1983.

SEASON = SUMMER 83

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	14.5	24.7	1402	145.4	134.8	41.0	213.2	30.1	15.1	9.5	181.8	4.1	1.07	0.3	1.97	13.9	1.97	0.254	16.4	0.21	0.028
2	12.2	21.6	1405	156.5	245.7	50.2	237.2	45.4	20.3	22.1	151.8	1.6	1.62	0.5	1.65	19.3	1.69	0.260	22.9	0.28	0.024
3	24.1	40.9	1918	205.9	137.0	55.2	202.1	23.9	15.2	8.2	201.6	3.2	1.40	0.2	1.99	15.6	2.62	0.344	21.8	0.29	0.030
4	18.2	17.1	1513	186.2	170.6	52.2	196.9	25.2	18.8	17.1	179.3	2.4	1.17	0.3	2.45	14.6	1.88	0.244	15.9	0.33	0.031
5	16.2	27.0	1514	181.6	181.2	75.0	202.8	32.0	39.5	34.5	181.8	3.1	1.52	0.6	4.45	16.2	2.46	0.308	20.6	0.99	0.132
6	14.7	25.5	1503	162.9	183.5	40.0	238.1	29.4	9.8	10.1	207.3	4.5	1.25	0.1	2.66	15.6	2.27	0.264	19.4	0.24	0.025
7	12.9	20.5	1164	132.7	116.4	41.5	156.1	22.3	13.8	12.3	137.9	2.4	1.07	0.3	1.19	12.4	1.54	0.284	20.5	0.27	0.014
8	5.8	11.2	796	93.1	128.0	23.6	152.3	27.0	11.5	18.6	127.5	3.7	0.78	0.1	0.93	8.0	0.64	0.190	9.5	0.24	0.009
9	13.4	22.1	1086	145.4	105.4	32.9	151.5	22.3	10.4	9.3	139.6	2.7	0.96	0.2	1.31	10.7	1.47	0.230	12.7	0.24	0.014
10	3.5	8.1	1545	160.4	302.5	63.7	234.4	104.1	14.9	16.5	185.6	4.0	2.09	0.2	2.04	24.4	2.14	0.267	18.2	0.34	0.013
11	6.1	10.7	1225	162.0	320.6	54.1	213.7	31.1	12.3	12.5	167.1	4.2	1.29	0.1	1.45	19.4	1.37	0.193	12.8	0.43	0.013
12	.	5.9	798	98.0	90.3	53.5	121.2	35.7	37.5	19.5	249.9	17.7	1.28	0.2	2.49	9.5	0.95	0.190	8.5	0.37	0.022
13	3.3	7.6	1263	160.3	254.3	33.3	210.1	28.9	23.0	9.2	159.3	7.9	1.76	0.2	1.60	21.8	1.83	0.225	24.1	0.89	0.022
15	10.5	13.0	1147	127.5	179.9	29.2	171.9	.	11.5	10.3	146.6	2.7	1.59	0.2	1.41	13.5	1.46	0.177	14.6	0.32	0.016
16	10.0	13.2	863	112.0	119.5	33.9	270.5	17.2	15.8	8.6	200.2	6.9	1.40	0.1	1.80	13.9	1.59	0.212	17.2	0.52	0.034
17	11.9	20.0	981	108.4	79.5	25.0	143.0	14.5	18.1	9.6	119.0	2.8	0.93	0.1	1.05	11.3	1.23	0.230	10.8	0.34	0.022
18	13.3	21.4	950	105.9	71.1	20.8	102.8	12.4	8.8	6.2	93.8	1.4	0.71	0.1	0.99	8.3	1.38	0.217	10.5	0.28	0.017
19	10.7	17.2	856	84.8	59.0	21.6	125.3	9.9	16.6	4.4	106.6	3.4	0.78	0.1	0.94	6.1	1.78	0.199	8.5	0.20	0.020
20	8.8	14.1	674	86.0	66.8	17.3	101.1	11.3	7.5	8.0	76.6	2.6	0.80	0.1	0.65	9.7	0.85	0.170	11.5	0.18	0.012
21	13.9	20.2	1072	120.9	96.7	28.5	152.6	17.7	12.0	9.3	131.7	2.8	1.12	0.1	1.62	12.6	1.20	0.190	11.0	0.33	0.013
22	12.8	22.0	966	84.8	66.4	26.2	135.5	9.4	12.2	11.2	98.4	4.4	1.08	0.1	1.24	22.8	1.09	0.270	18.9	0.36	0.029
23	13.1	21.7	1129	124.5	90.1	29.8	246.4	14.2	19.5	11.1	137.4	6.9	1.01	0.1	1.84	10.8	1.26	0.253	9.8	0.50	0.025
24	3.0	5.4	309	23.7	18.0	7.9	61.4	3.3	13.4	6.4	45.7	3.1	0.32	0.0	0.66	3.2	0.74	0.080	2.3	0.15	0.011
25	5.7	12.3	562	53.4	51.5	64.8	125.6	8.8	14.8	40.3	89.8	6.5	0.83	0.2	1.59	9.8	1.06	0.282	9.5	0.31	0.021
26	1.5	3.6	161	25.1	19.5	10.5	36.9	2.0	5.2	5.1	32.3	0.4	0.32	0.0	0.32	4.0	0.18	0.092	3.1	0.13	0.005
26A	5.9	9.3	417	38.5	23.5	12.6	58.3	4.9	9.9	6.2	46.0	1.4	0.38	0.1	0.89	4.5	0.38	0.139	4.5	0.20	0.020
27	5.5	23.2	540	58.0	65.3	13.7	91.0	9.2	14.7	10.9	74.4	2.2	0.72	0.2	0.91	8.4	2.14	0.335	7.8	0.43	0.017
28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	1.6	4.2	252	57.3	50.4	9.2	93.9	5.7	8.0	6.9	71.9	1.6	0.46	0.1	0.29	2.7	0.11	0.229	4.8	0.18	0.011
30A	1.3	6.7	151	22.4	20.5	8.0	37.4	2.7	3.4	2.1	28.1	0.4	0.36	0.1	0.19	5.4	0.32	0.107	4.1	0.10	0.005
31	1.5	5.9	295	47.2	60.4	17.2	111.2	8.1	11.0	12.2	73.6	3.7	0.67	0.1	0.69	7.7	0.25	0.247	7.7	0.21	0.015
32	2.9	10.8	460	72.3	84.2	16.4	138.1	11.3	24.8	14.4	124.5	2.4	1.42	0.2	1.08	12.5	0.83	0.450	14.3	0.36	0.022
33	1.2	5.9	219	53.2	46.3	5.0	105.0	7.8	13.3	4.1	73.9	4.2	0.93	0.3	0.47	19.5	0.98	0.268	12.2	0.21	0.018
34	0.4	4.7	187	49.6	62.5	4.2	93.3	14.8	22.7	5.7	65.6	1.6	0.99	0.1	0.99	11.3	0.35	0.233	11.6	0.29	0.012
35	2.2	7.1	282	60.8	56.8	10.8	108.4	18.0	28.2	2.9	71.1	7.7	1.18	0.2	0.78	19.1	0.41	0.310	18.3	0.33	0.015
36	1.6	5.8	219	43.6	59.8	8.9	73.0	12.0	17.8	3.9	45.7	5.0	0.98	0.2	0.60	12.1	0.61	0.262	10.9	0.54	0.014

* NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 12:

Seasonal Wet Deposition (mg/m^2) - Autumn 1983

SEASON = AUTUMN 83

ID	HF	HT	SO4	N_NO3	CA	CL	N_TKN	MG	K	NA	N_NH4	P_PO4	MN	NI	ZN	FE	PB	V	AL	CU	CD
1	12.1	18.1	752	90.2	61.1	39.6	72.1	14.2	4.8	7.3	60.5	1.3	0.75	0.1	5.50	12.4	1.39	0.243	14.8	0.20	0.053
2	9.6	14.5	755	115.4	117.6	37.3	83.7	23.3	6.9	9.0	63.5	2.0	0.74	0.4	1.68	11.6	1.16	0.232	12.6	0.26	0.032
3	6.8	8.8	593	87.5	124.8	49.4	155.6	27.1	16.8	10.2	87.8	7.0	0.84	0.2	1.72	13.6	1.16	0.210	12.2	0.24	0.032
4	12.6	18.3	848	109.3	104.0	31.5	91.0	13.0	5.3	11.0	77.7	0.9	0.88	0.2	2.30	20.7	1.77	0.250	21.6	0.26	0.036
5	7.2	12.4	557	80.1	63.8	31.8	50.8	11.8	4.4	7.6	42.7	1.1	0.56	0.1	1.41	8.9	1.83	0.217	9.5	0.20	0.039
6	3.6	8.1	685	85.8	148.2	12.9	115.2	24.7	6.4	5.7	95.7	2.3	1.32	0.1	2.00	35.8	2.32	0.183	31.9	0.20	0.016
7	6.2	11.6	546	77.0	52.7	19.8	91.2	12.2	8.2	10.0	63.7	2.3	0.51	0.1	1.32	7.6	1.24	0.197	6.8	0.22	0.011
8	5.6	11.1	653	94.0	81.5	12.6	111.6	18.7	7.0	7.3	95.8	1.6	0.79	0.1	1.47	13.0	1.02	0.215	12.9	0.23	0.024
9	7.5	13.6	599	97.8	59.8	12.5	98.0	12.7	5.2	6.4	80.3	1.5	0.61	0.1	1.10	9.9	0.97	0.244	10.4	0.18	0.013
10	10.3	8.3	642	87.6	206.5	37.0	87.6	42.5	6.9	11.8	71.1	1.4	0.99	0.1	1.37	4.8	0.89	0.170	3.2	0.14	0.009
11	6.9	12.1	555	92.1	71.6	20.9	87.4	9.4	5.5	5.2	62.7	1.5	0.49	0.1	0.94	4.8	0.84	0.206	5.2	0.23	0.031
12	11.4	14.8	698	135.5	67.9	28.7	98.9	8.5	7.7	10.1	78.5	2.7	0.65	0.1	1.57	8.0	0.97	0.276	5.8	0.22	0.014
13	5.9	10.5	429	82.4	57.8	25.4	92.4	5.9	9.0	8.2	59.0	4.3	0.38	0.1	0.92	6.9	1.21	0.190	6.3	0.15	0.009
15	3.8	9.3	503	85.7	92.8	23.7	55.9	33.2	3.6	15.7	43.6	0.6	0.96	0.1	1.30	14.6	1.27	0.245	13.1	0.21	0.025
16	6.0	13.1	605	97.5	89.5	23.2	181.4	11.8	16.1	24.1	87.6	6.1	0.92	0.1	2.21	6.7	1.24	0.258	7.0	0.26	0.020
17	7.0	12.9	483	83.2	41.2	19.0	71.9	6.0	7.7	11.6	55.4	2.2	0.67	0.1	1.81	12.0	1.54	0.232	12.0	0.39	0.025
18	11.6	14.5	634	131.1	38.3	22.9	85.0	5.9	6.5	7.0	76.5	1.9	0.49	0.1	1.22	4.8	1.39	0.278	5.5	0.21	0.018
19	9.6	16.8	572	93.0	23.4	9.5	63.5	4.9	5.0	9.1	50.7	1.6	0.33	0.1	1.47	8.8	0.84	0.264	8.5	0.18	0.016
20	13.5	17.0	632	121.5	42.0	18.5	106.1	6.5	6.0	7.6	104.6	1.7	0.27	0.2	0.89	3.2	1.26	0.315	3.9	0.22	0.016
21	9.1	17.2	653	104.6	48.6	16.9	92.6	9.9	8.8	10.7	77.0	1.3	0.52	0.3	1.05	17.2	1.47	0.343	17.2	0.25	0.025
22	9.4	11.5	820	78.7	30.4	26.5	69.4	3.0	8.1	15.4	39.4	18.1	2.61	1.5	0.79	11.7	3.13	0.297	40.1	0.35	0.015
23	9.4	14.3	560	90.4	46.1	11.7	69.8	6.4	7.5	6.1	62.9	1.4	0.53	0.1	1.41	12.0	1.11	0.223	12.5	0.20	0.014
24	4.6	5.0	209	39.3	14.3	20.9	65.1	2.9	17.1	7.0	18.8	3.5	0.24	0.1	1.64	3.2	0.78	0.058	3.3	0.42	0.041
25	3.8	6.6	204	31.7	12.5	4.6	27.0	2.2	3.6	2.6	22.5	1.0	0.14	0.1	0.62	4.7	0.77	0.143	6.9	0.15	0.017
26	4.3	8.9	467	75.3	17.4	13.9	52.5	11.2	18.0	8.1	43.2	7.5	0.65	0.1	1.41	4.5	0.54	0.217	8.8	0.44	0.014
27	4.7	8.5	312	33.7	28.1	23.0	25.9	5.5	8.1	16.4	21.1	1.6	0.32	0.1	0.48	5.1	0.37	0.190	6.7	0.19	0.016
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	4.2	8.3	309	33.7	22.9	12.4	56.8	3.9	7.4	10.2	36.9	3.2	0.21	0.1	0.76	2.7	0.42	0.230	4.7	0.41	0.021
31	6.9	11.6	309	52.7	24.1	11.7	32.5	3.5	3.3	9.5	9.4	2.1	0.25	0.1	0.66	3.7	0.46	0.270	6.0	0.25	0.017
32	2.8	7.6	286	48.8	47.8	5.7	49.4	9.5	12.8	11.6	34.3	1.8	0.68	0.3	0.89	10.1	0.19	0.265	12.8	0.21	0.013
33	1.9	4.0	150	25.0	18.1	3.6	24.5	2.7	3.5	4.1	16.1	0.8	0.22	0.1	0.44	6.7	0.24	0.110	8.8	0.16	0.033
34	0.9	2.8	109	17.2	11.2	3.9	24.5	1.5	2.3	3.8	20.9	0.9	0.19	0.0	0.39	6.4	0.27	0.094	7.7	0.10	0.005
35	2.3	3.7	181	31.0	12.6	10.4	20.2	6.9	4.4	10.1	28.0	3.4	0.45	0.1	0.99	10.9	0.49	0.128	12.4	0.29	0.029
36	0.7	3.4	74	10.8	10.8	11.7	15.2	2.4	3.7	9.1	9.9	0.8	0.25	0.1	0.25	4.1	0.15	0.161	5.4	0.12	0.012
37	11.1	18.6	731	103.7	45.3	30.9	116.3	7.4	6.9	10.0	96.7	3.6	0.74	0.2	1.19	8.3	1.18	0.357	9.7	0.26	0.025

NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 13:

Seasonal Geometric Mean Air Concentration (ug/m^3) - Winter 82/83.

SEASON = WINTER 82/83 (DEC 82 - FEB 83)

ID	SO2	SO4	S	N_NO3	CL	CA	MG	K	NA	FE	AL	PB	MN	CU	NI	VN	ZN	CD
1	18.22	6.21	11.18	1.37	0.77	0.58	0.149	0.103	0.291	0.106	0.056	0.094	0.0031	0.0021	0.00035	0.0007	0.056	0.00009
3	16.79	5.23	10.21	1.22	0.63	0.42	0.073	0.075	0.220	0.081	0.039	0.068	0.0082	0.0013	0.00032	0.0006	0.032	0.00052
4	24.65	7.01	14.67	1.27	0.96	1.04	0.106	0.083	0.273	0.081	0.054	0.086	0.0086	0.0024	0.00034	0.0017	0.041	0.00039
8	11.80	5.51	7.76	1.14	0.54	0.75	0.263	0.053	0.201	0.058	0.020	0.062	0.0039	0.0017	0.00079	0.0007	0.024	0.00030
9	7.91	4.19	5.52	0.92	0.33	0.23	0.050	0.050	0.282	0.041	0.024	0.058	0.0049	0.0007	0.00030	0.0006	0.020	0.00028
10	8.88	1.72	5.01	0.57	0.38	0.30	0.075	0.023	0.350	0.145	0.031	0.052	0.0075	0.0039	0.00075	0.0015	0.013	0.00024
11	10.19	4.49	6.59	0.90	0.70	0.79	0.086	0.064	0.380	0.064	0.039	0.052	0.0031	0.0038	0.00046	0.0008	0.031	0.00004
13	6.41	3.68	4.49	0.69	0.48	0.91	0.052	0.083	0.300	0.055	0.031	0.057	0.0048	0.0026	0.00089	0.0025	0.015	0.00031
15	7.12	3.36	4.70	0.65	0.68	0.35	0.098	0.086	0.511	0.046	0.032	0.066	0.0089	0.0007	0.00162	0.0057	0.020	0.00046
16	8.69	4.44	5.90	0.76	1.42	1.00	0.160	0.178	1.007	0.091	0.065	0.086	0.0216	0.0027	0.00383	0.0129	0.029	0.00044
17	4.62	2.92	3.35	0.49	0.22	0.18	0.053	0.063	0.248	0.046	0.023	0.033	0.0038	0.0019	0.00094	0.0033	0.010	0.00027
20	5.13	2.96	3.58	0.46	0.16	0.09	0.027	0.044	0.148	0.042	0.027	0.032	0.0008	0.0012	0.00030	0.0006	0.021	0.00035
21	5.47	3.29	3.87	0.53	0.42	0.16	0.032	0.068	0.397	0.040	0.016	0.046	0.0009	0.0018	0.00046	0.0006	0.017	0.00025
22	4.65	4.04	3.72	0.47	0.27	0.11	0.035	0.230	0.251	0.048	0.010	0.061	0.0008	0.0013	0.00060	0.0015	0.019	0.00015
23	6.72	3.19	4.42	0.45	0.21	0.09	0.033	0.063	0.089	0.024	0.018	0.031	0.0022	0.0003	0.00034	0.0007	0.010	0.00021
25	4.23	2.63	3.00	0.34	0.08	0.06	0.027	0.037	0.137	0.024	0.009	0.028	0.0016	0.0014	0.00035	0.0007	0.017	0.00033
27	2.27	1.80	1.75	0.14	0.14	0.06	0.034	0.032	0.146	0.028	0.013	0.017	0.0008	0.0015	0.00027	0.0005	0.008	0.00017
28	2.54	3.80	2.54	0.21	1.38	0.21	0.220	0.222	0.695	0.045	0.024	0.036	0.0044	0.0011	0.00109	0.0022	0.073	0.00107
30A	2.08	2.06	1.73	0.13	0.10	0.10	0.083	0.052	0.134	0.142	0.023	0.032	0.0021	0.0006	0.00034	0.0007	0.005	0.00013
31	1.42	1.76	1.30	0.14	0.07	0.08	0.028	0.024	0.120	0.042	0.007	0.010	0.0015	0.0005	0.00030	0.0009	0.004	0.00005
35	1.00	2.01	1.17	0.19	0.15	0.12	0.037	0.027	0.198	0.036	0.018	0.012	0.0022	0.0005	0.00112	0.0010	0.003	0.00009
36	1.94	2.27	1.73	0.12	0.04	0.13	0.033	0.023	0.119	0.026	0.005	0.012	0.0011	0.0003	0.00033	0.0007	0.003	0.00011

* CONCENTRATIONS ARE GEOMETERIC MEAN VALUES.
NUMBER UNDERLINED CORRESPOND TO DATA WHICH
[illegible]

TABLE 14:

Seasonal Goemetric Mean Air Concentration (ug/m^3) - Spring 1983.

SEASON = SPRING 83 (MAR - MAY)

ID	SO2	SO4	S	N_NO3	CL	CA	MG	K	NA	FE	AL	PB	MN	CU	NI	VN	ZN	CD
1	12.48	2.96	7.36	0.69	0.31	0.47	0.145	0.046	0.106	0.123	0.072	0.068	0.0087	0.0028	0.00053	0.0009	0.036	0.00041
3	10.08	4.41	6.52	0.92	0.42	0.62	0.121	0.066	0.142	0.165	0.084	0.063	0.0114	0.0019	0.00101	0.0007	0.023	0.00030
4	13.32	4.19	8.07	0.89	0.52	1.21	0.205	0.051	0.147	0.130	0.079	0.056	0.0085	0.0029	0.00056	0.0006	0.026	0.00031
8	3.33	3.37	2.80	0.65	0.27	0.46	0.160	0.032	0.139	0.066	0.040	0.040	0.0052	0.0020	0.00058	0.0007	0.015	0.00013
9	3.79	3.13	2.97	0.50	0.22	0.32	0.077	0.040	0.119	0.081	0.040	0.028	0.0047	0.0018	0.00034	0.0007	0.011	0.00021
10	10.44	4.38	6.74	0.79	0.72	1.14	0.364	0.117	0.264	0.202	0.079	0.167	0.0158	0.0027	0.00121	0.0009	0.039	0.00042
11	6.69	3.49	4.68	0.48	0.31	1.49	0.084	0.039	0.151	0.093	0.039	0.045	0.0074	0.0024	0.00068	0.0010	0.013	0.00035
13	3.67	3.00	2.84	0.39	0.19	0.77	0.043	0.048	0.101	0.073	0.029	0.043	0.0042	0.0016	0.00042	0.0010	0.012	0.00030
15	3.18	2.67	2.51	0.40	0.22	0.63	0.240	0.061	0.134	0.066	0.025	0.049	0.0079	0.0017	0.00026	0.0005	0.021	0.00023
16	5.36	3.91	4.07	0.57	0.39	0.71	0.086	0.088	0.246	0.115	0.052	0.083	0.0107	0.0026	0.00087	0.0040	0.038	0.00051
17	2.49	2.47	2.10	0.21	0.12	0.08	0.041	0.051	0.113	0.053	0.023	0.038	0.0030	0.0017	0.00053	0.0012	0.010	0.00040
20	3.08	2.42	2.35	0.21	0.09	0.06	0.067	0.031	0.044	0.065	0.041	0.021	0.0020	0.0019	0.00045	0.0006	0.010	0.00034
21	3.58	2.59	2.66	0.23	0.10	0.17	0.030	0.036	0.104	0.074	0.023	0.031	0.0020	0.0018	0.00029	0.0006	0.011	0.00033
22	4.37	2.37	2.98	0.13	0.10	0.11	0.055	0.042	0.121	0.194	0.070	0.034	0.0050	0.0020	0.00044	0.0006	0.016	0.00063
23	4.14	2.62	2.96	0.24	0.10	0.14	0.035	0.040	0.106	0.051	0.020	0.026	0.0024	0.0024	0.00031	0.0006	0.008	0.00028
25	2.44	1.97	1.90	0.10	0.07	0.09	0.038	0.075	0.100	0.087	0.042	0.024	0.0027	0.0032	0.00029	0.0006	0.012	0.00034
27	1.13	1.72	1.14	0.08	0.10	0.22	0.057	0.041	0.110	0.057	0.024	0.018	0.0025	0.0017	0.00030	0.0008	0.007	0.00020
28	0.41	1.84	0.82	0.07	0.35	0.67	0.145	0.055	0.118	0.054	0.051	0.018	0.0028	0.0011	0.00089	0.0006	0.006	0.00013
30A	1.17	2.07	1.16	0.09	0.15	0.19	0.044	0.024	0.107	0.059	0.015	0.008	0.0015	0.0008	0.00033	0.0007	0.004	0.00008
31	1.08	2.15	1.40	0.11	0.07	0.14	0.040	0.037	0.109	0.057	0.030	0.009	0.0029	0.0005	0.00032	0.0006	0.005	0.00012
35	0.77	1.79	1.01	0.07	0.10	0.12	0.041	0.031	0.101	0.086	0.028	0.012	0.0025	0.0005	0.00029	0.0006	0.005	0.00009
36	1.02	1.82	1.13	0.06	0.09	0.24	0.086	0.024	0.114	0.080	0.032	0.016	0.0026	0.0022	0.00102	0.0006	0.004	0.00008

TABLE 15:

Seasonal Geometric Mean Air Concentration (ug/m^3) - Summer 1983.

SEASON = SUMMER 83 (JUN - AUG)

ID	SO2	SO4	S	N_NO3	CL	CA	MG	K	NA	FE	AL	PB	MN	CU	NI	VN	ZN	CD
1	11.68	9.32	8.44	1.40	0.54	0.82	0.248	0.088	0.121	0.127	0.098	0.095	0.0103	0.0036	0.00087	0.0006	0.033	0.00056
3	5.46	8.03	5.55	1.04	0.46	0.71	0.137	0.092	0.078	0.103	0.098	0.066	0.0107	0.0032	0.00034	0.0007	0.028	0.00044
4	13.38	9.39	10.14	1.27	0.69	1.18	0.169	0.088	0.096	0.146	0.138	0.079	0.0096	0.0032	0.00035	0.0007	0.028	0.00038
8	3.88	7.65	4.50	0.87	0.40	1.08	0.387	0.084	0.071	0.076	0.095	0.055	0.0093	0.0026	0.00062	0.0007	0.016	0.00020
9	3.48	6.41	3.88	0.57	0.35	0.58	0.169	0.062	0.089	0.069	0.073	0.038	0.0069	0.0023	0.00073	0.0007	0.012	0.00029
10	6.19	7.23	5.92	0.90	0.46	1.84	0.846	0.110	0.103	0.149	0.054	0.143	0.0204	0.0037	0.00052	0.0007	0.034	0.00053
11	3.59	6.86	4.09	0.55	0.32	2.79	0.140	0.142	0.104	0.079	0.109	0.050	0.0121	0.0026	0.00033	0.0009	0.017	0.00038
13	3.69	6.49	3.71	0.60	0.30	2.75	0.134	0.082	0.122	0.125	0.134	0.051	0.0108	0.0022	0.00049	0.0009	0.016	0.00019
15	1.84	4.36	2.39	0.39	0.14	1.62	0.760	0.055	0.077	0.105	0.034	0.041	0.0162	0.0024	0.00044	0.0005	0.014	0.00014
16	2.48	5.12	2.98	0.31	0.31	0.56	0.065	0.093	0.081	0.082	0.091	0.041	0.0083	0.0025	0.00040	0.0006	0.013	0.00019
17	1.77	4.94	2.45	0.19	0.18	0.18	0.047	0.059	0.067	0.071	0.065	0.027	0.0060	0.0012	0.00081	0.0008	0.009	0.00024
20	2.19	4.33	2.49	0.27	0.15	0.17	0.066	0.046	0.056	0.144	0.124	0.024	0.0054	0.0017	0.00032	0.0006	0.010	0.00028
21	3.63	4.87	3.46	0.29	0.21	0.21	0.049	0.061	0.062	0.067	0.055	0.035	0.0047	0.0020	0.00029	0.0006	0.010	0.00035
22	1.96	4.05	2.23	0.18	0.26	0.21	0.134	0.094	0.092	0.272	0.216	0.034	0.0109	0.0032	0.00046	0.0009	0.010	0.00026
23	3.57	5.17	3.66	0.31	0.19	0.22	0.061	0.063	0.070	0.069	0.068	0.032	0.0058	0.0027	0.00066	0.0006	0.010	0.00029
25	1.99	3.02	2.02	0.13	0.13	0.11	0.057	0.042	0.055	0.100	0.106	0.021	0.0049	0.0036	0.00073	0.0006	0.008	0.00035
27	0.94	2.17	1.21	0.08	0.12	0.54	0.121	0.039	0.057	0.090	0.106	0.017	0.0048	0.0012	0.00051	0.0007	0.005	0.00023
28	0.96	2.57	1.36	0.05	0.30	4.67	1.103	0.086	0.264	0.235	0.021	0.049	0.0105	0.0013	0.00074	0.0018	0.014	0.00014
30	0.02	1.22	0.42	0.08	0.14	0.35	0.078	0.042	0.170	0.045	0.037	0.006	0.0042	0.0003	0.00035	0.0007	0.005	0.00003
30A	0.74	1.85	0.99	0.13	0.17	1.57	0.293	0.061	0.072	0.235	0.193	0.020	0.0086	0.0019	0.00034	0.0007	0.003	0.00007
31	0.41	0.90	0.43	0.07	0.07	0.10	0.049	0.032	0.042	0.048	0.077	0.008	0.0041	0.0007	0.00045	0.0007	0.002	0.00005
35	0.25	0.93	0.49	0.10	0.11	0.16	0.056	0.058	0.050	0.097	0.108	0.021	0.0046	0.0014	0.00051	0.0007	0.004	0.00005
36	0.12	1.07	0.44	0.07	0.08	0.34	0.078	0.042	0.043	0.071	0.103	0.017	0.0060	0.0034	0.00109	0.0006	0.004	0.00006

* CONCENTRATIONS ARE GEOMETRIC MEAN VALUES.
NUMBERS UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE.

TABLE 16:

Seasonal Geometric Mean Concentration Air (ug/m3) - Autumn 1983.

SEASON = AUTUMN 83 (SEPT - NOV)

ID	SO2	SO4	S	N_NO3	CL	CA	MG	K	NA	FE	AL	PB	MN	CU	NI	VN	ZN	CD
1	11.34	5.07	7.00	1.02	0.62	0.58	0.153	0.087	0.132	0.094	0.055	0.074	0.0096	0.0019	0.00032	0.0010	0.051	0.00071
3	9.88	4.38	6.08	0.91	0.40	0.49	0.087	0.077	0.112	0.096	0.059	0.058	0.0093	0.0017	0.00034	0.0011	0.029	0.00050
4	15.76	4.88	7.06	1.02	0.48	0.94	0.117	0.078	0.168	0.082	0.070	0.064	0.0083	0.0020	0.00046	0.0017	0.039	0.00054
8	5.09	3.82	3.40	0.92	0.39	0.50	0.130	0.061	0.104	0.066	0.040	0.049	0.0058	0.0017	0.00049	0.0010	0.024	0.00038
9	3.02	3.32	2.27	0.60	0.23	0.25	0.059	0.055	0.095	0.047	0.025	0.038	0.0036	0.0008	0.00079	0.0007	0.013	0.00028
10	4.63	4.90	4.04	0.80	0.50	0.80	0.229	0.077	0.200	0.110	0.050	0.148	0.0133	0.0023	0.00031	0.0019	0.062	0.00076
11	2.15	2.95	2.08	0.59	0.23	0.45	0.043	0.062	0.116	0.051	0.033	0.049	0.0049	0.0009	0.00033	0.0007	0.031	0.00039
13	1.68	3.01	1.85	0.53	0.19	0.63	0.045	0.066	0.109	0.053	0.039	0.057	0.0050	0.0008	0.00034	0.0014	0.013	0.00031
15	1.35	2.36	1.47	0.51	0.22	0.85	0.337	0.065	0.158	0.055	0.046	0.058	0.0219	0.0026	0.00027	0.0019	0.026	0.00033
16	2.04	3.08	2.07	0.50	0.26	0.64	0.070	0.176	0.164	0.072	0.058	0.075	0.0156	0.0019	0.00051	0.0045	0.027	0.00043
17	0.98	2.27	1.29	0.26	0.08	0.14	0.030	0.065	0.097	0.036	0.021	0.033	0.0047	0.0017	0.00037	0.0012	0.012	0.00024
20	2.51	2.60	2.16	0.31	0.16	0.08	0.023	0.039	0.086	0.041	0.019	0.019	0.0030	0.0023	0.00033	0.0007	0.009	0.00022
21	3.46	2.03	2.42	0.30	0.19	0.10	0.023	0.041	0.126	0.037	0.021	0.029	0.0027	0.0011	0.00030	0.0006	0.009	0.00027
22	1.96	1.72	1.57	0.13	0.17	0.14	0.039	0.047	0.104	0.112	0.054	0.040	0.0059	0.0012	0.00056	0.0006	0.011	0.00039
23	6.11	1.75	3.69	0.35	0.18	0.10	0.029	0.045	0.108	0.055	0.027	0.027	0.0024	0.0041	0.00046	0.0005	0.006	0.00058
25	3.73	2.02	2.59	0.20	0.12	0.07	0.016	0.030	0.089	0.034	0.024	0.017	0.0018	0.0023	0.00051	0.0009	0.010	0.00036
27	2.24	1.59	1.72	0.09	0.20	0.17	0.046	0.040	0.131	0.043	0.025	0.012	0.0019	0.0013	0.00054	0.0006	0.006	0.00021
28	.	5.41	1.80	0.05	4.04	.	.	.	2.343	0.071	0.042	0.020	0.0058	0.0072	0.00180	0.0036	0.047	.
30	0.13	0.92	0.44	0.07	0.04	0.13	0.034	0.016	0.097	0.031	0.015	0.005	0.0007	0.0005	0.00034	0.0007	0.006	0.00005
31	0.27	1.04	0.45	0.06	0.03	0.03	0.029	0.030	0.076	0.032	0.026	0.010	0.0015	0.0007	0.00035	0.0007	0.003	0.00005
35	0.44	0.89	0.40	0.08	0.02	0.03	0.021	0.022	0.065	0.035	0.021	0.011	0.0010	0.0003	0.00029	0.0006	0.002	0.00004
36	0.51	1.09	0.48	0.09	0.04	0.07	0.028	0.036	0.109	0.034	0.018	0.013	0.0010	0.0006	0.00036	0.0007	0.002	0.00010
37	1.79	1.15	1.28	0.14	0.10	0.03	0.019	0.022	0.080	0.026	0.013	0.005	0.0017	0.0010	0.00032	0.0006	0.003	0.00010

* CONCENTRATIONS ARE GEOMETERIC MEAN VALUES.
NUMBER UNDERLINED CORRESPOND TO DATA WHICH ARE LESS THAN TWO-THIRDS COMPLETE

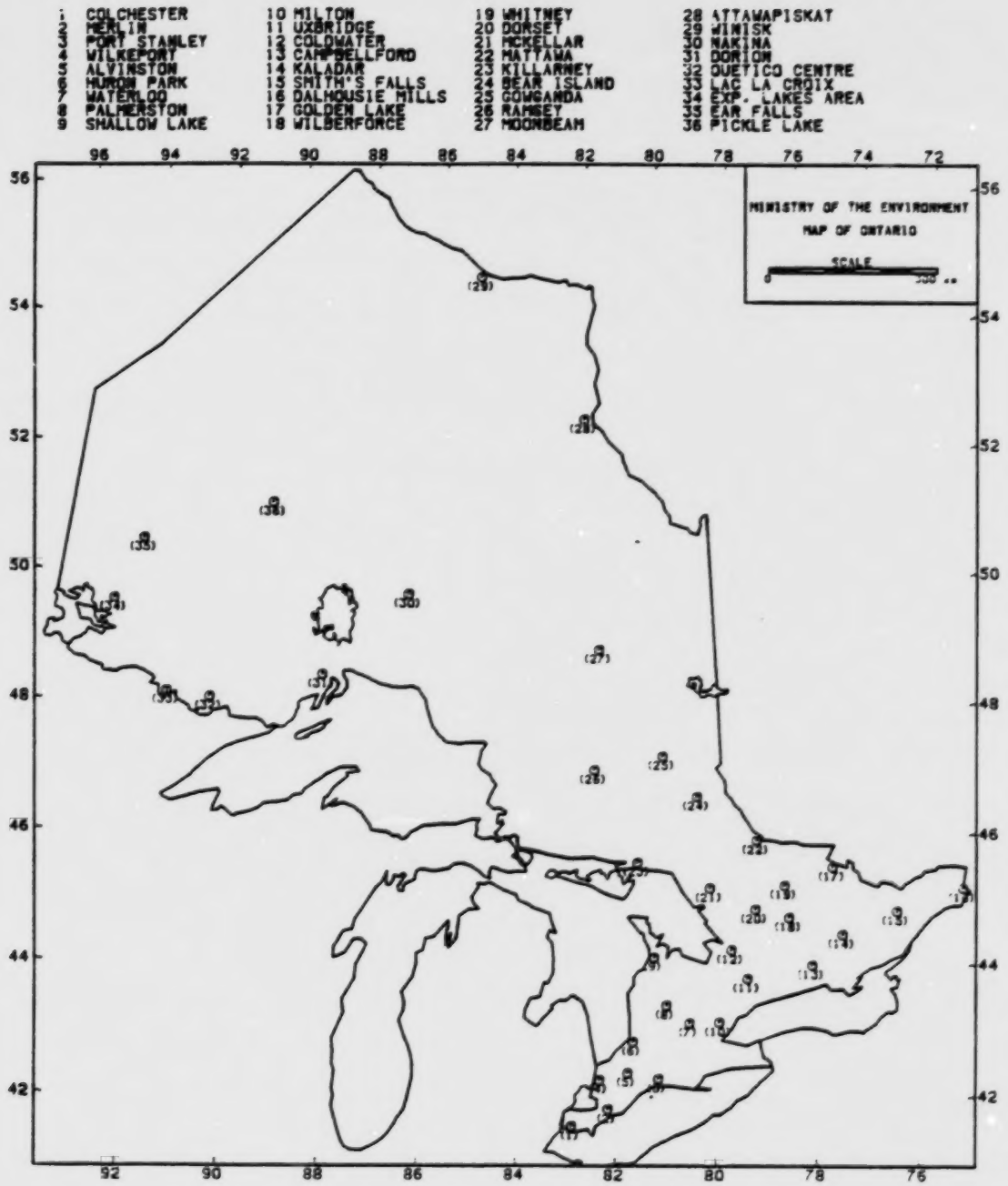


Figure 1. APIOS cumulative deposition network site location map (1983).

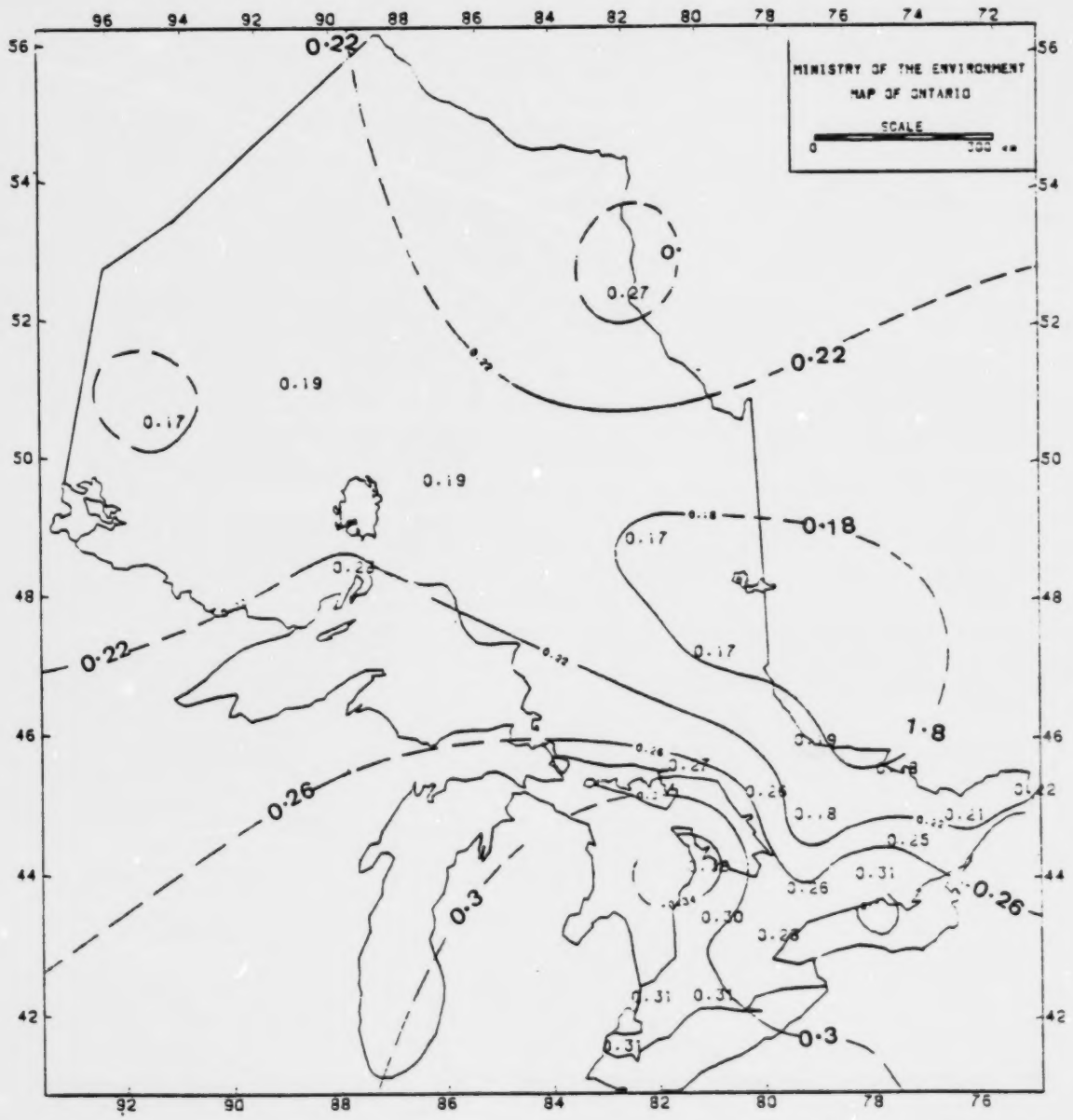


Figure 2. Annual average dry deposition velocity (cm/sec.) of SO_2.

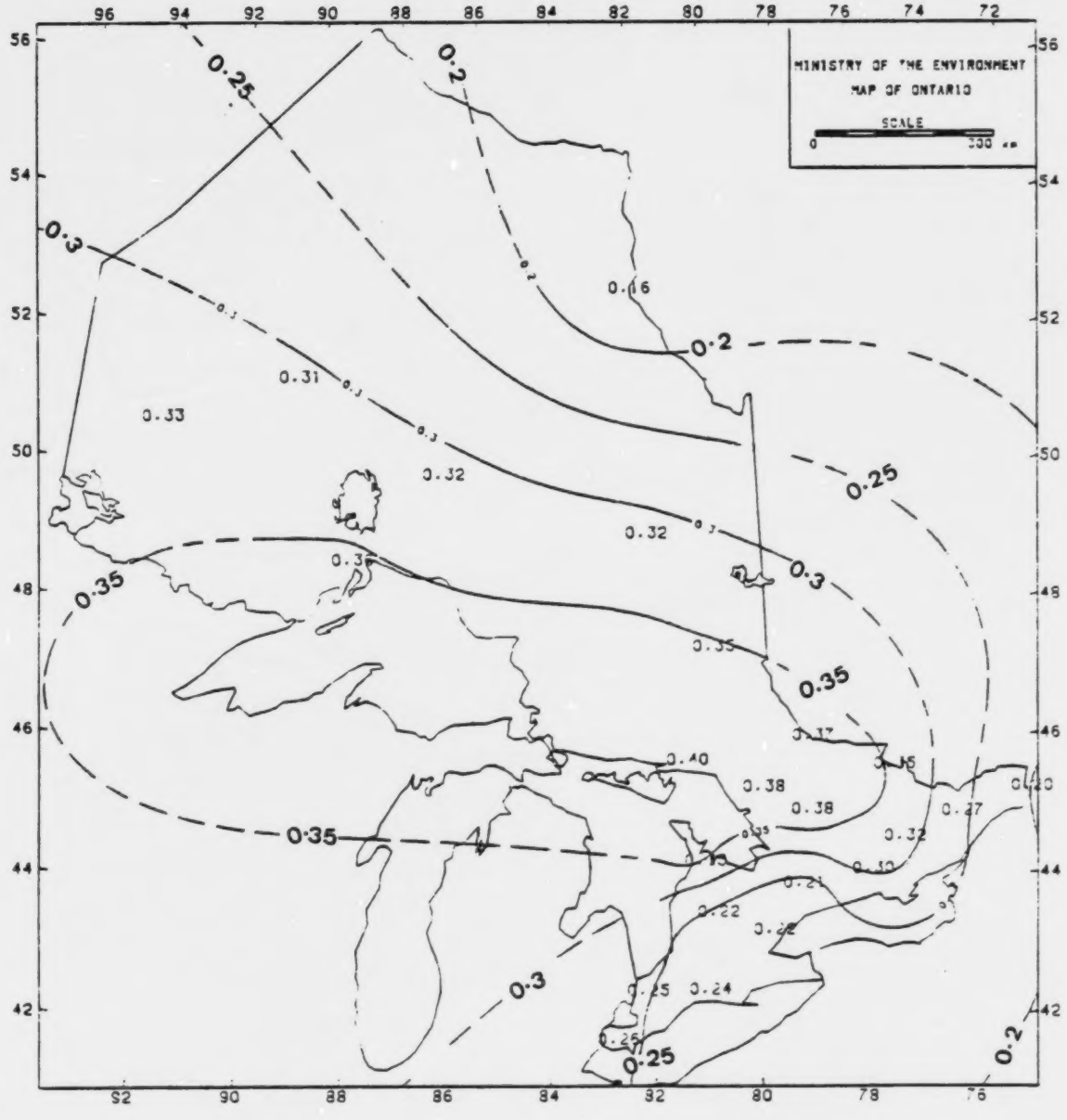


Figure 3. Annual average dry deposition velocity (cm/sec.) of SO_4.

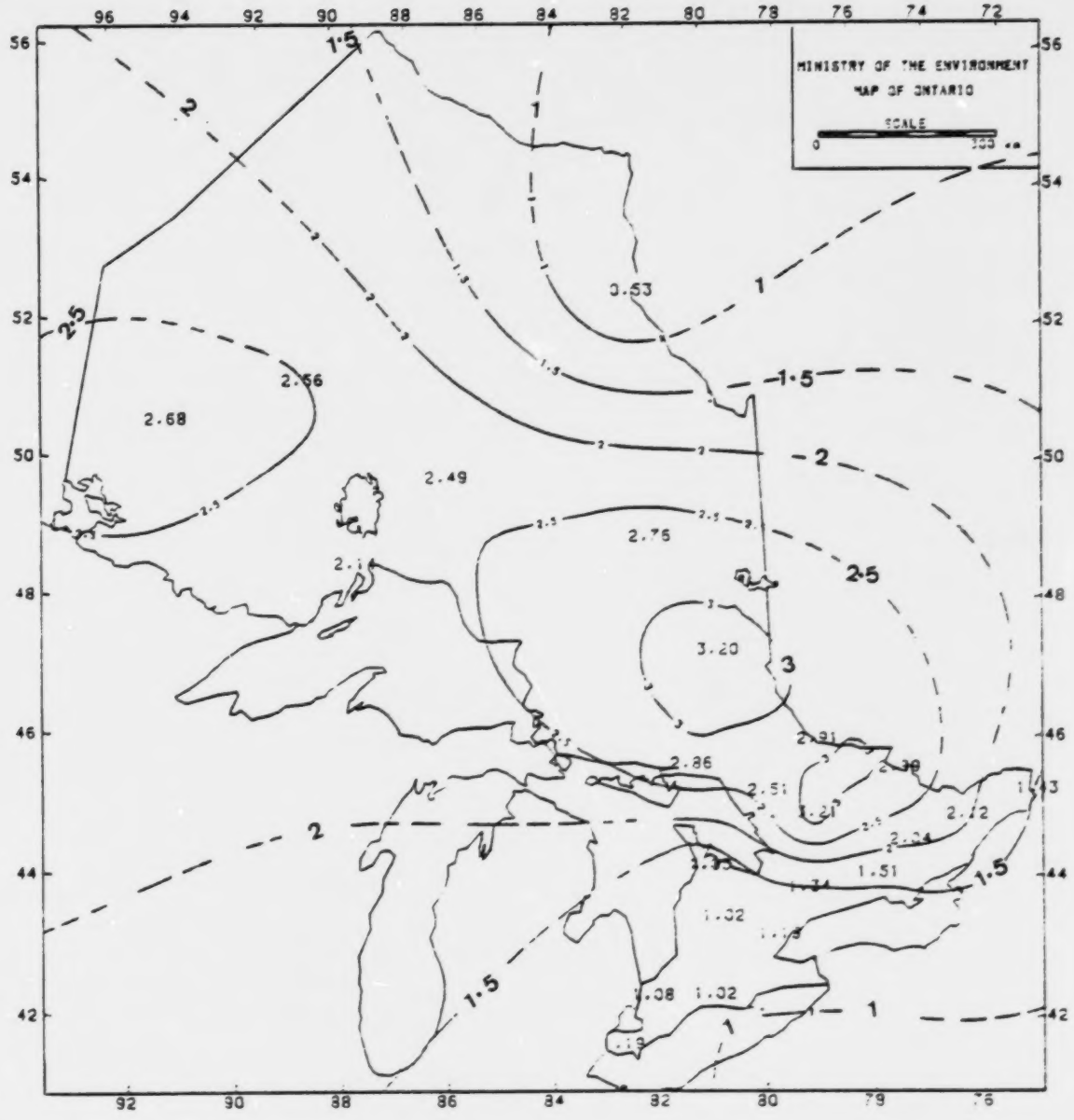


Figure 4. Annual average dry deposition velocity (cm/sec.) of HNO_3.

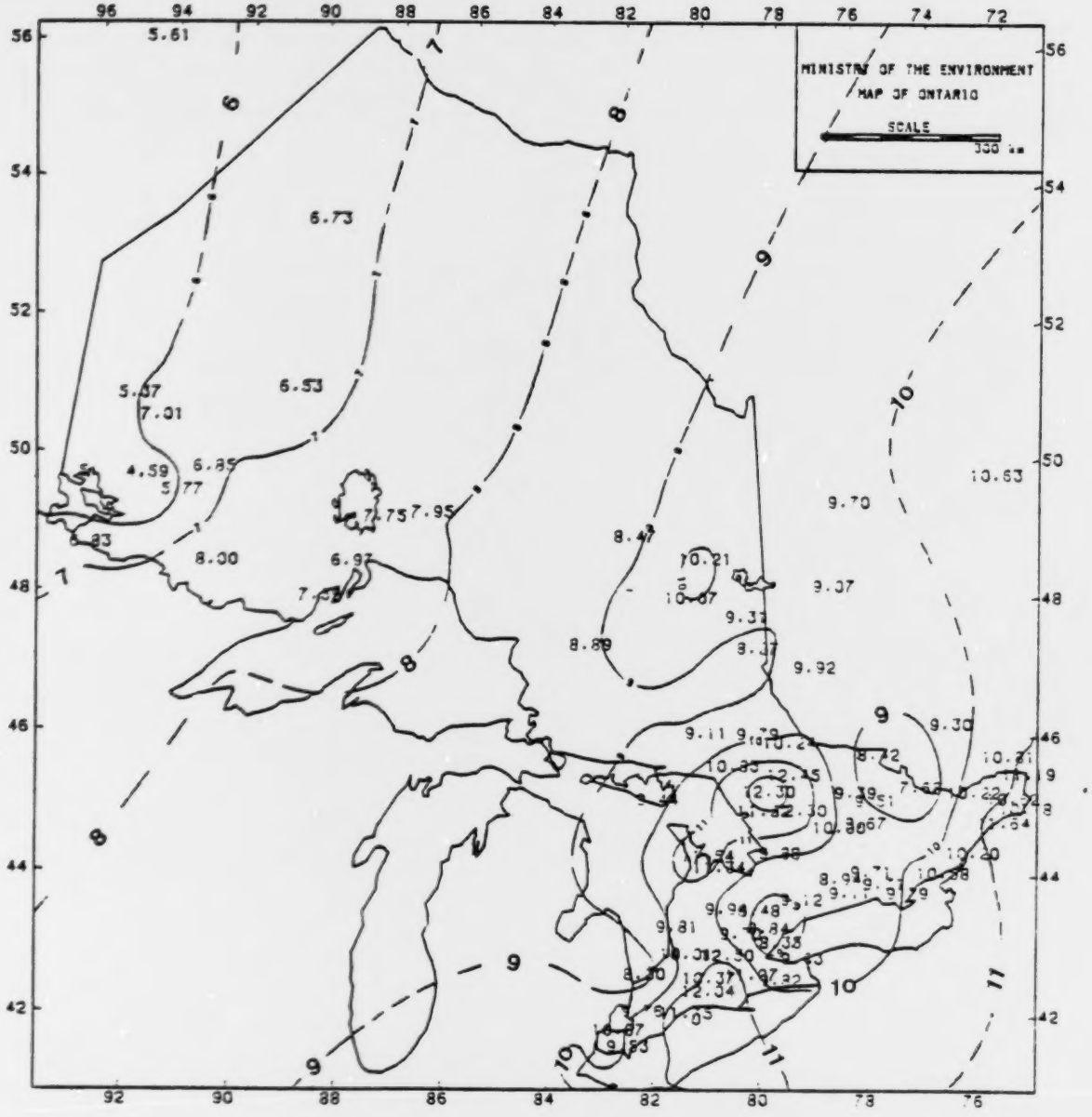


Figure 5. Annual climate precipitation gauge depth (10cm).

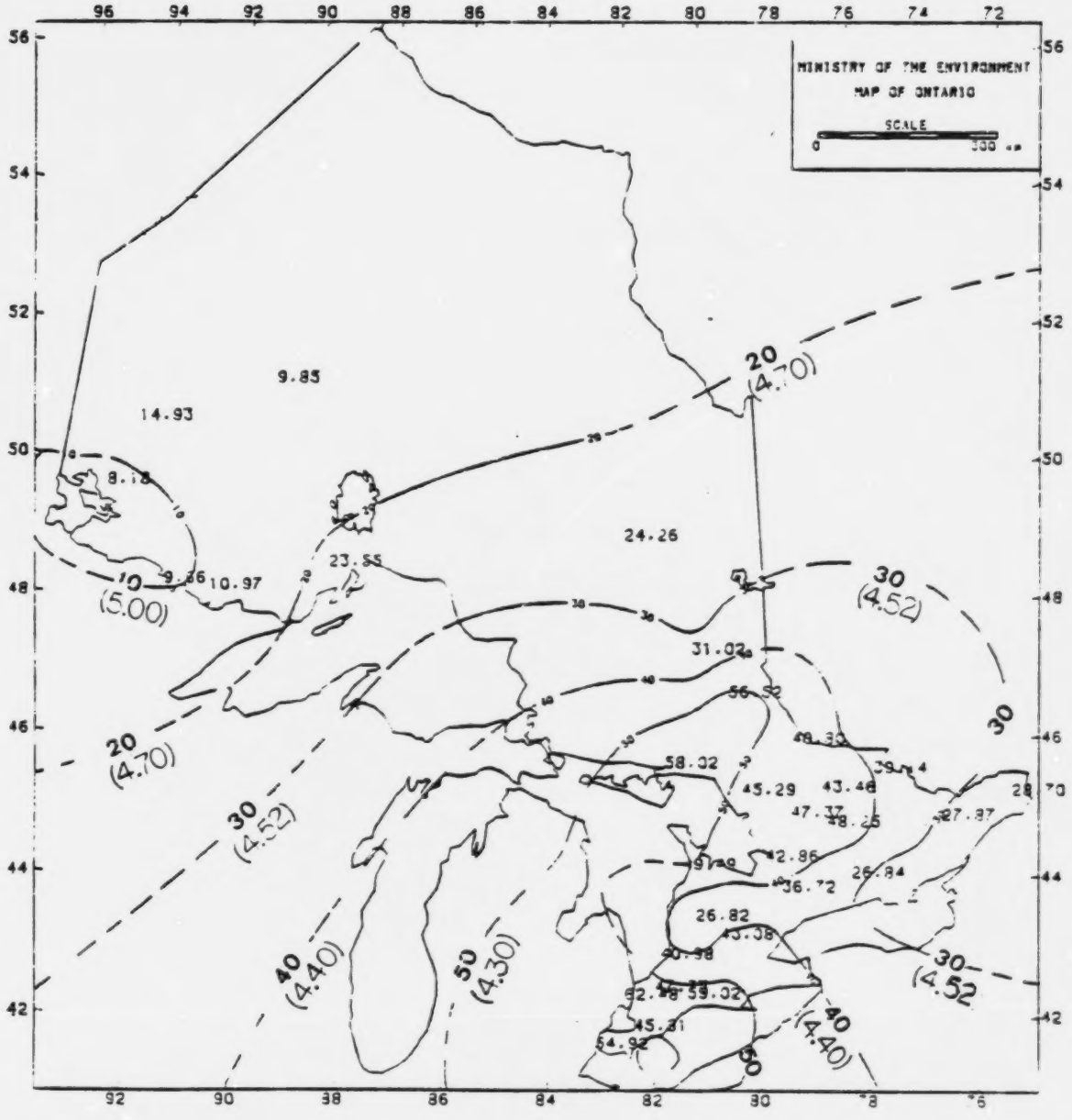


Figure 6a. Annual average precipitation concentration (ug/l) Of H_f -1983. (The corresponding PH values are shown in brackets).

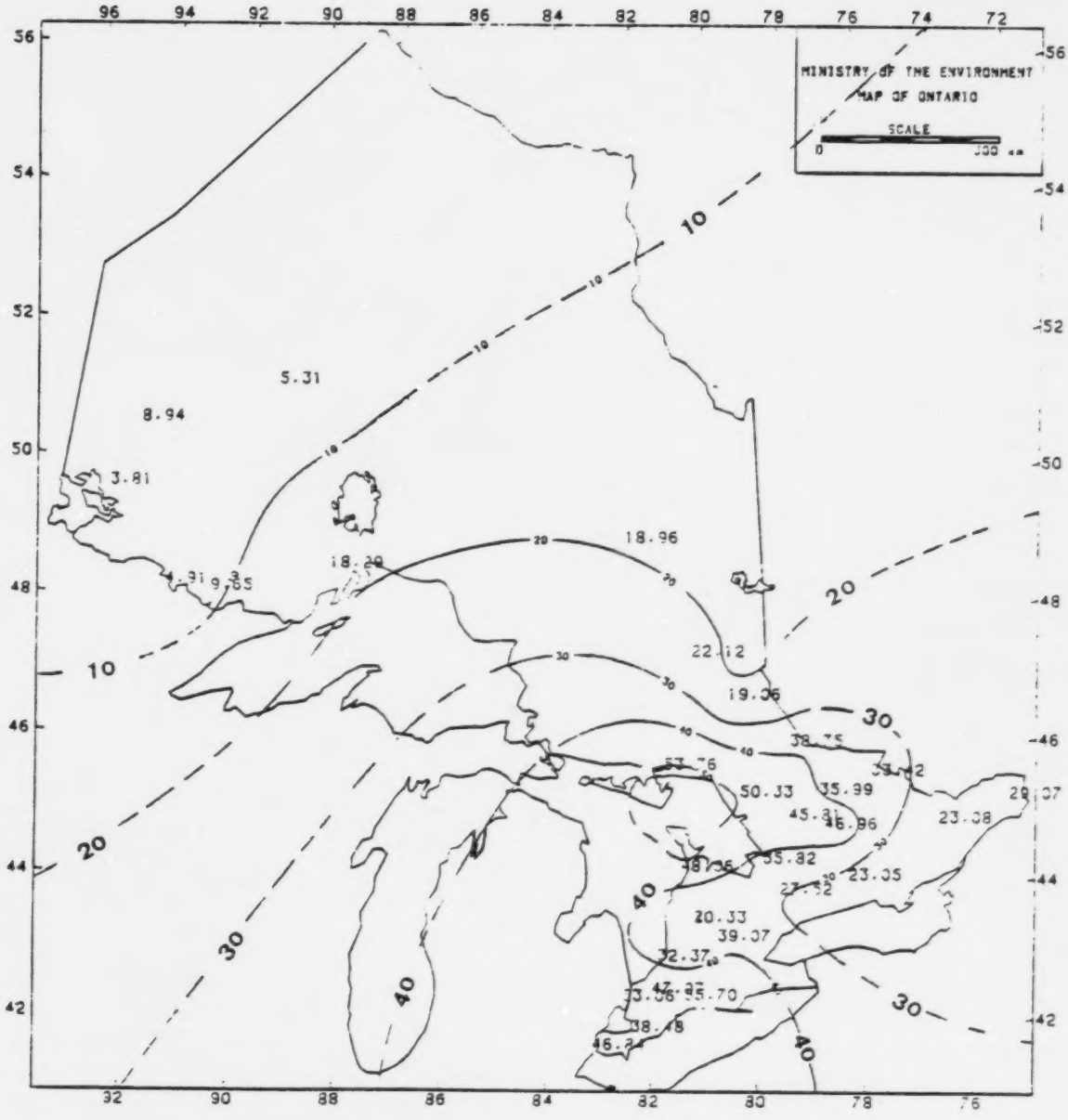


Figure 6b. Annual wet deposition (mg/m^2) of H_f - 1983.

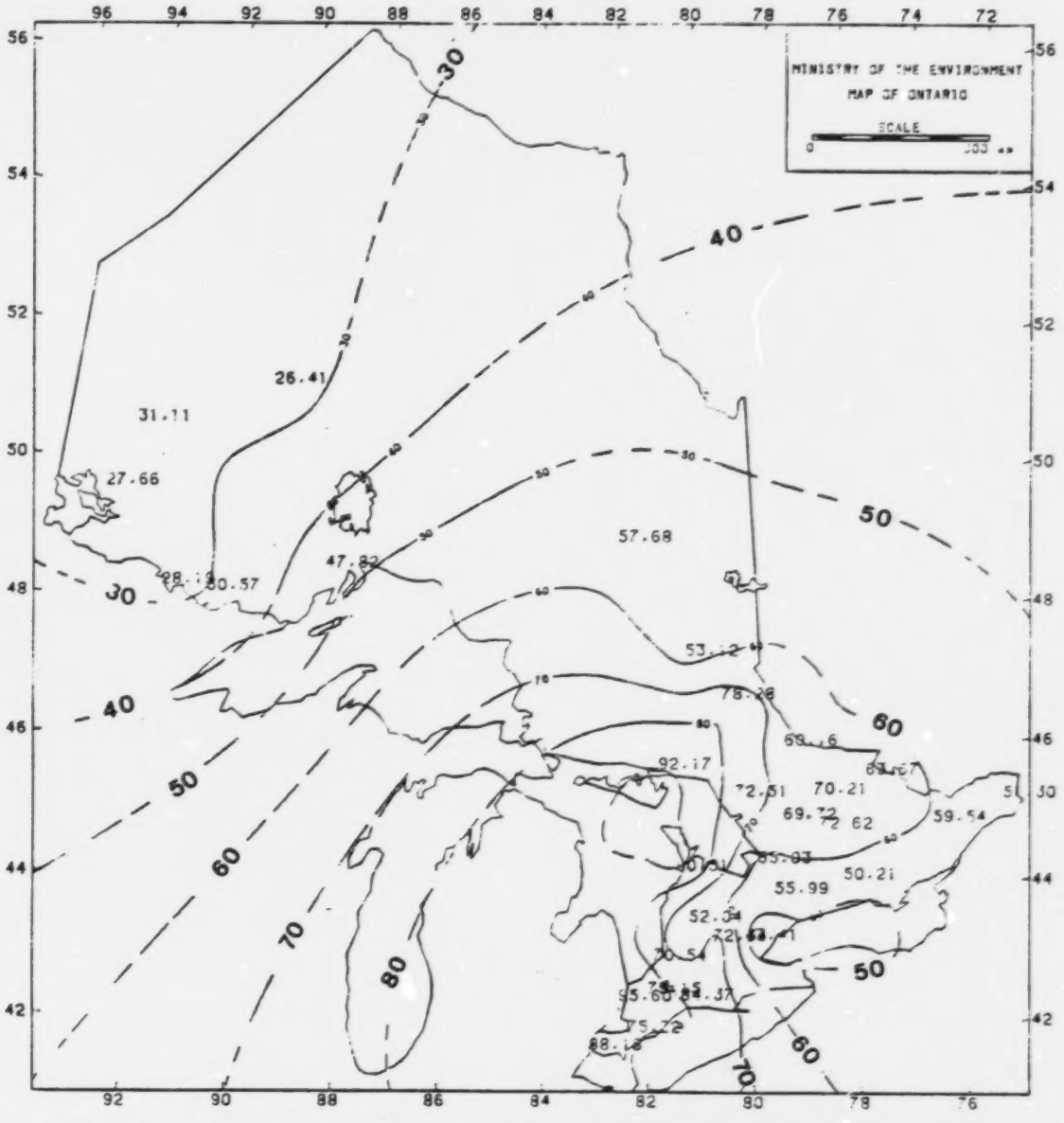


Figure 7a. Annual average precipitation concentration (ug/l) of H_t -1983.

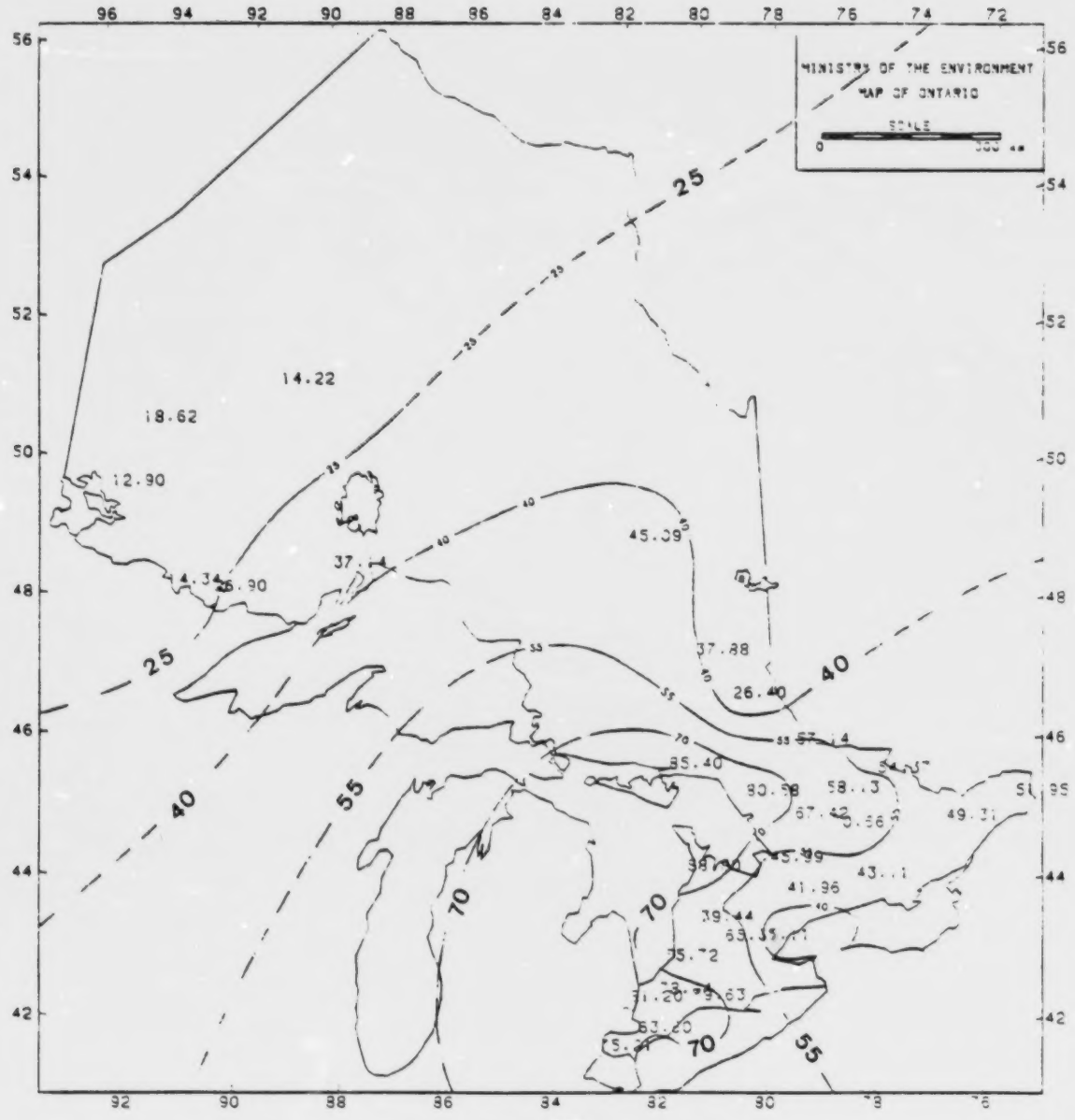


Figure 7b. Annual wet deposition (mg/m^2) of H_t - 1983.

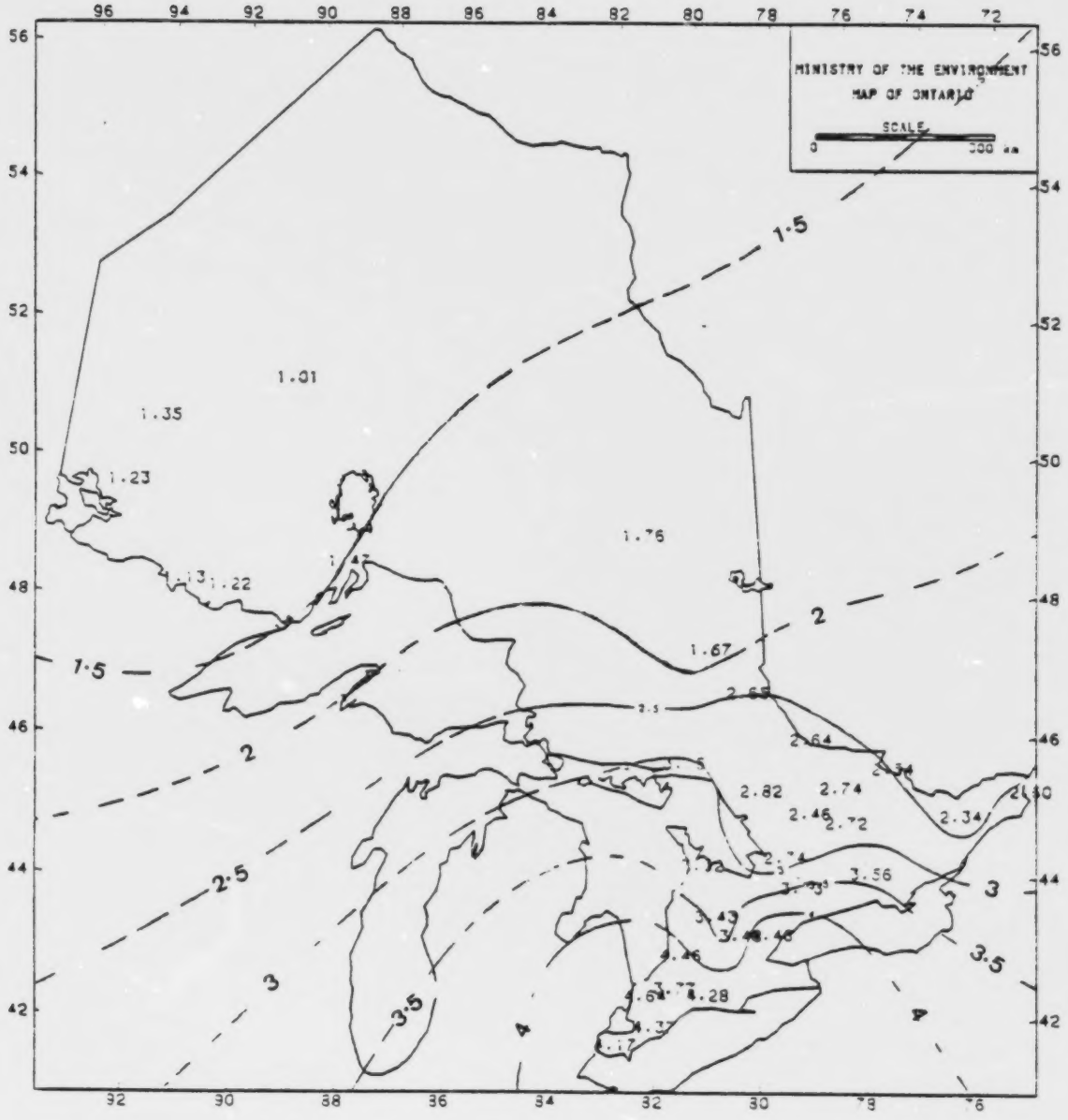


Figure 8a. Annual average precipitation concentration (mg/l) of SO_4 -1983.

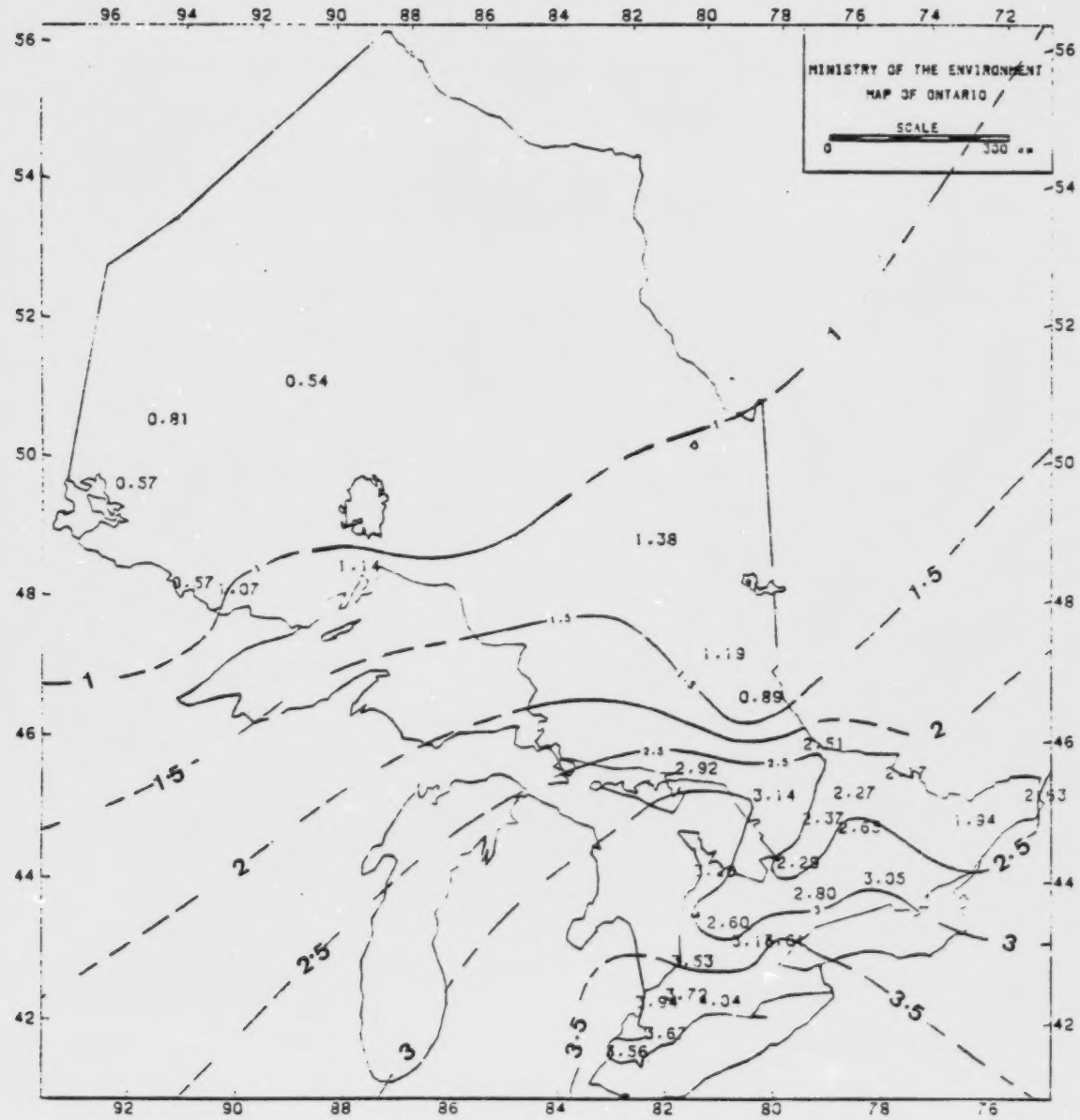


Figure 3b. Annual wet deposition (g/m^2) of SO_4 - 1983.

Figure 9a. Annual average precipitation concentration (mg/l) of $N\text{-}NO_3$ - 1983.

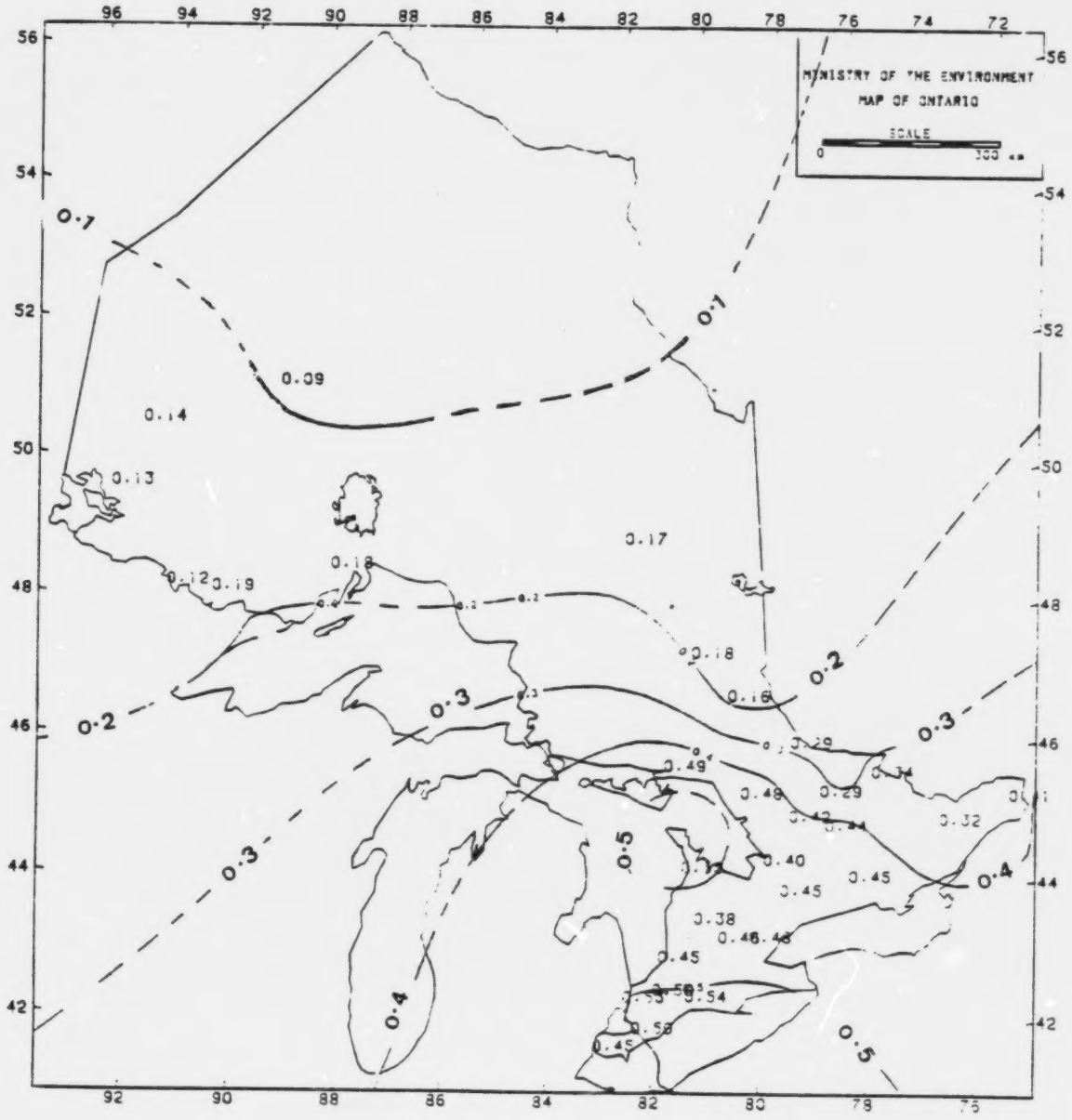


Figure 9b. Annual wet deposition (g/m^2) of $N\text{-}NO_3$ - 1983.

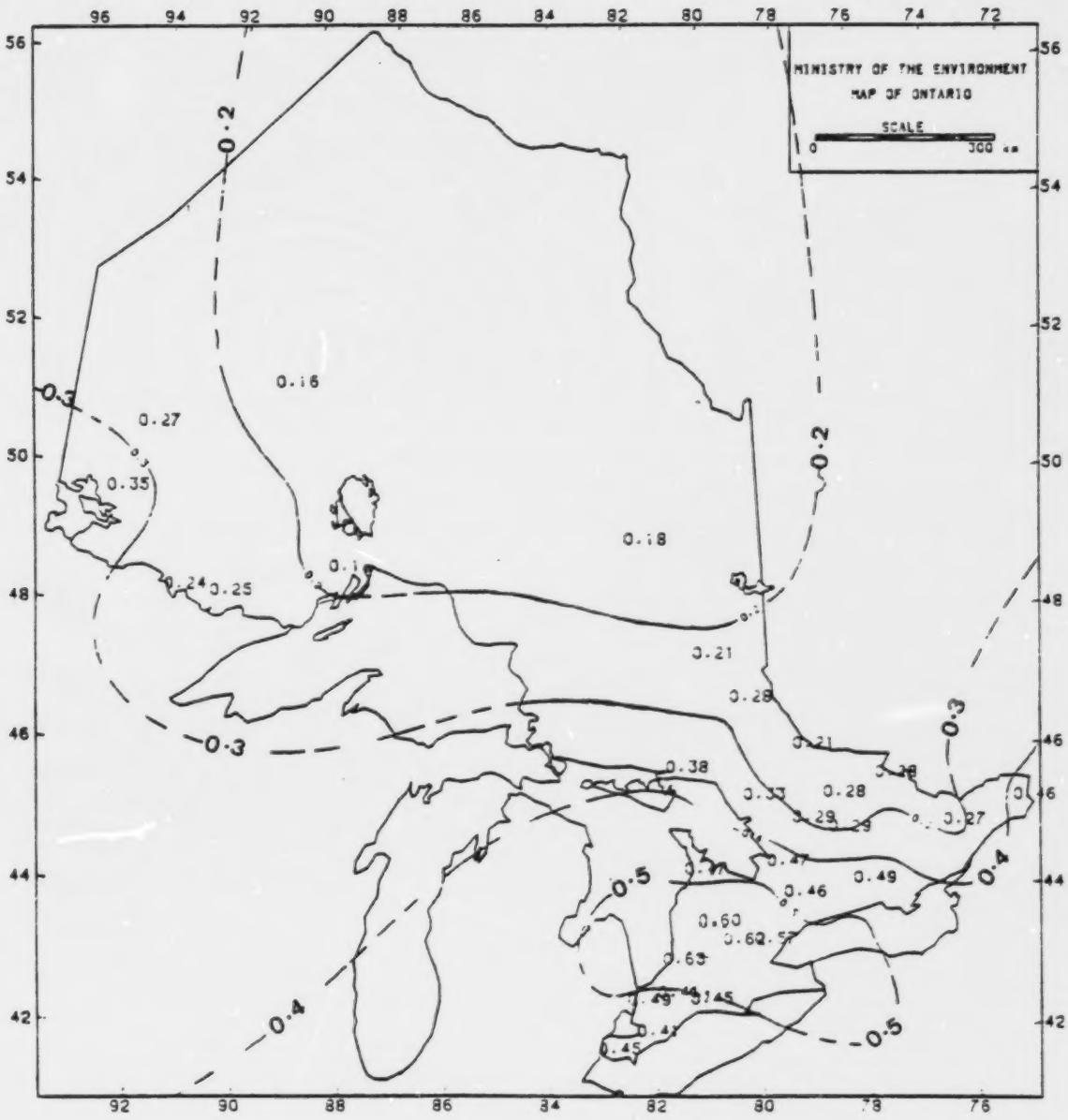


Figure 10a. Annual average precipitation concentration (mg/l) of $N\text{-}NH_4$ - 1983.

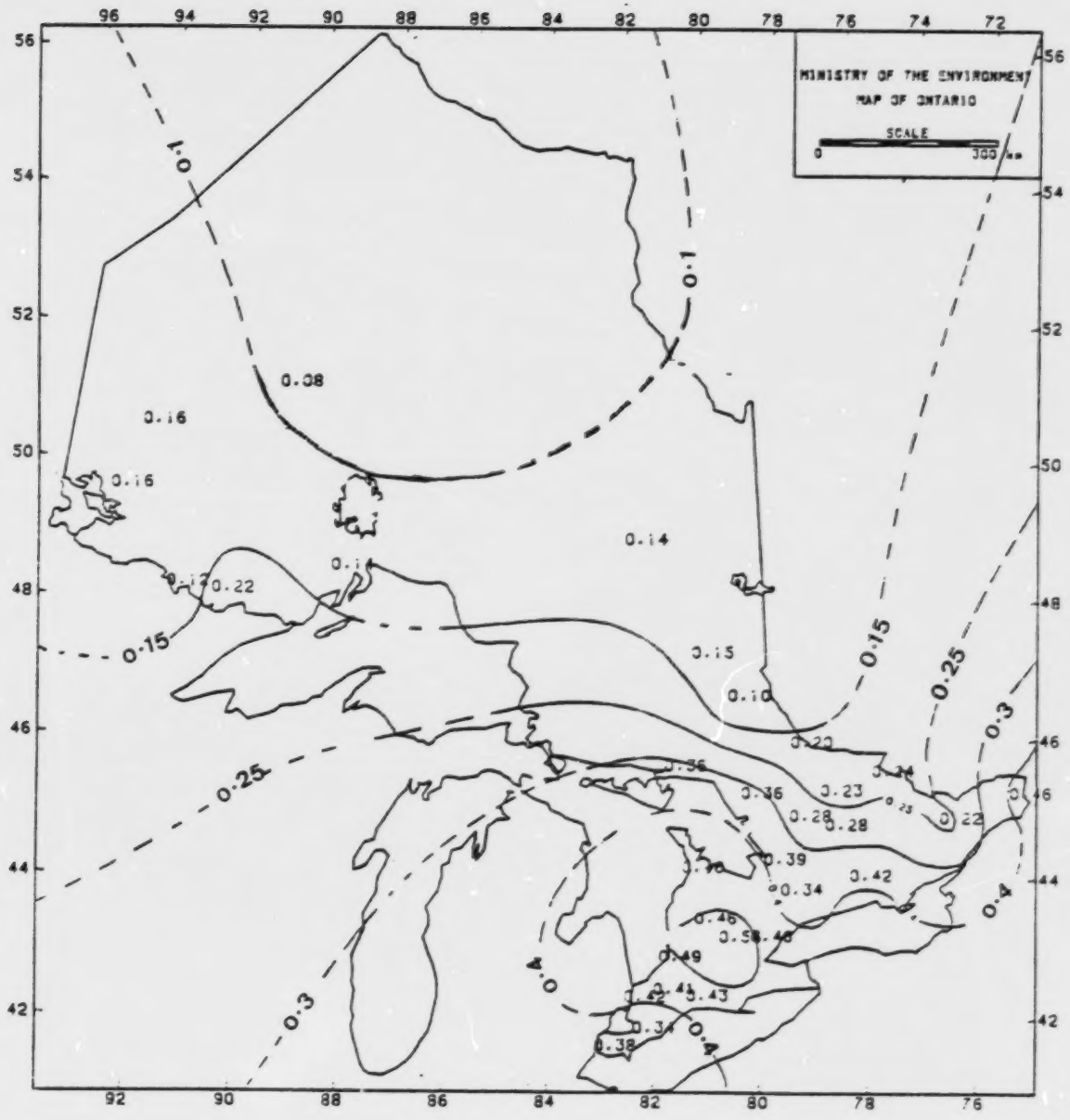


Figure 10b. Annual wet deposition (g/m^2) of $N\text{-}NH_4$ - 1983.

Figure 11a. Annual average precipitation concentration (mg/l) of N-TKN - 1983.

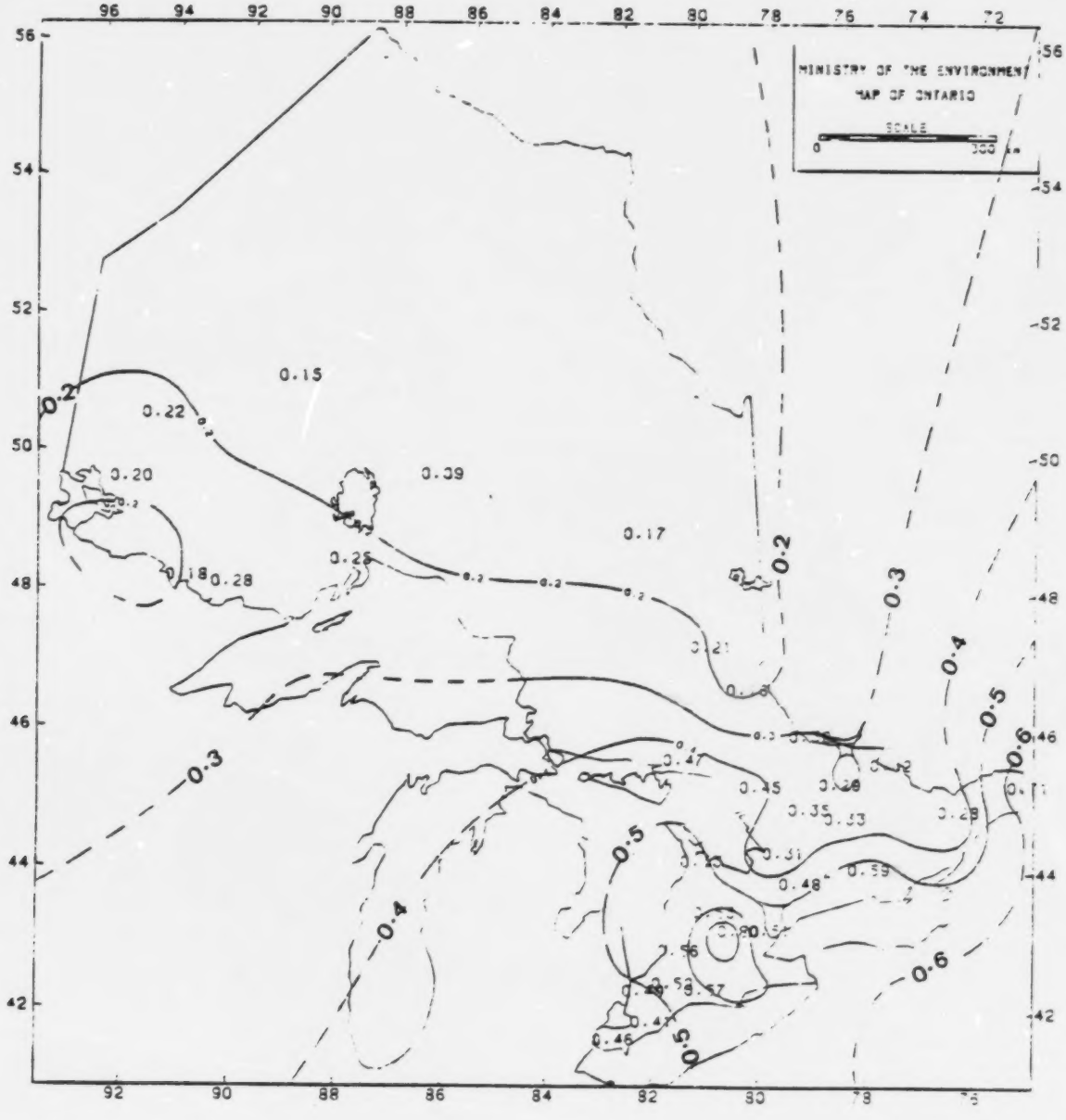


Figure 11b. Annual wet deposition (g/m^2) of N-TKN - 1983.

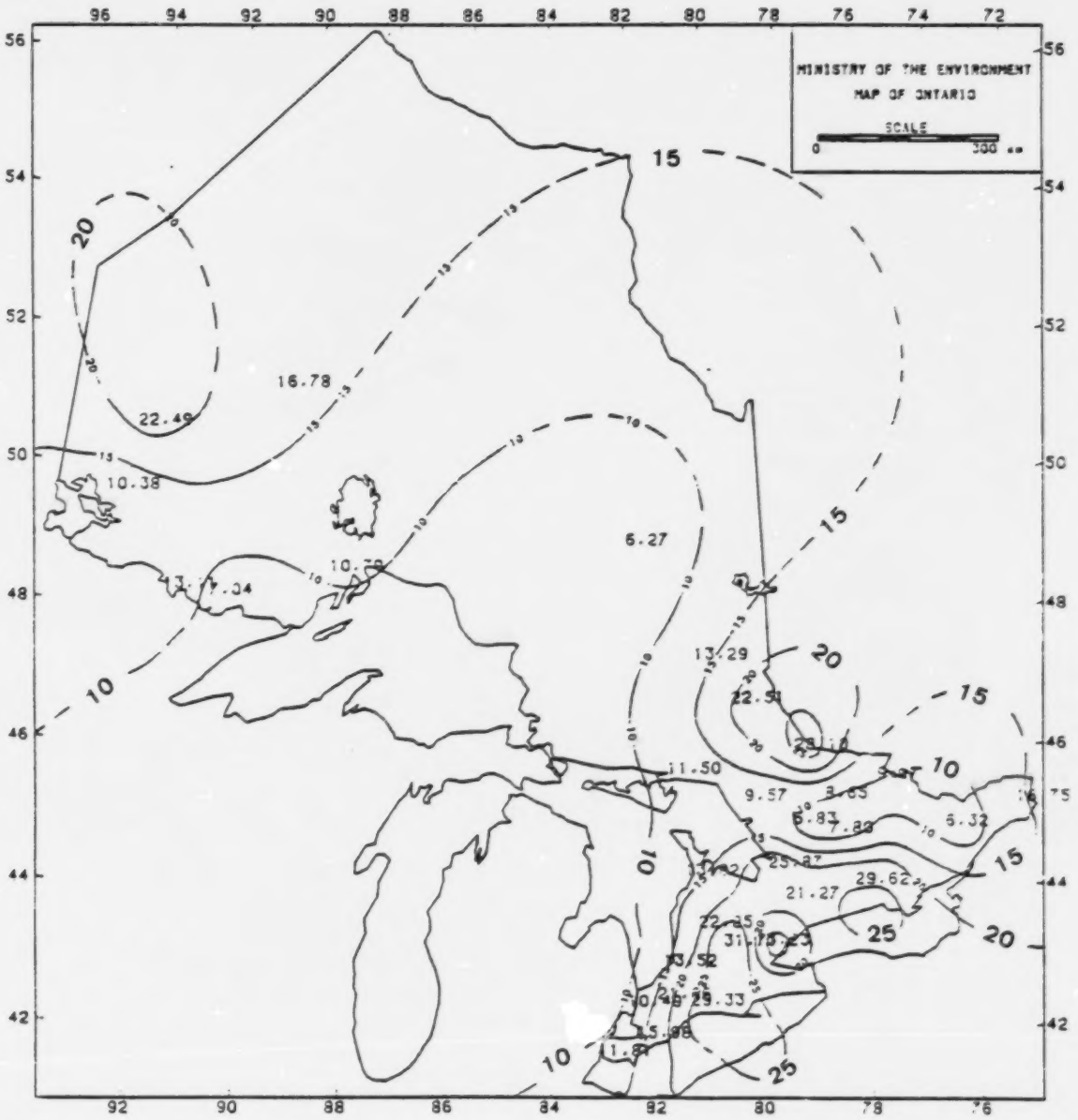


Figure 12a. Annual averaged precipitation concentration (ug/l) of $P\text{-}PO_4$ - 1983.

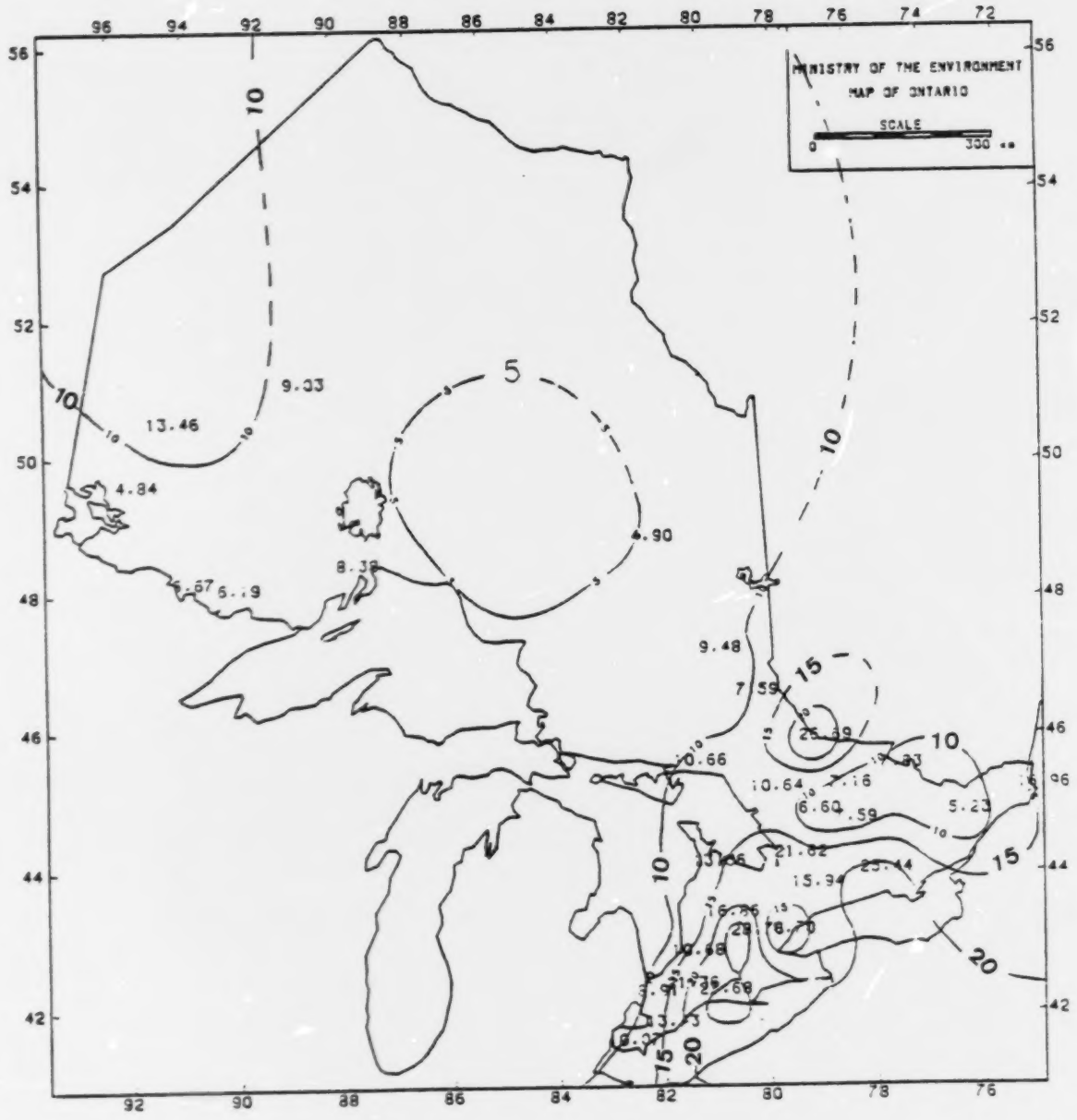


Figure 12b. Annual wet deposition (mg/m^2) of $P\text{-}PO_4$ - 1983.

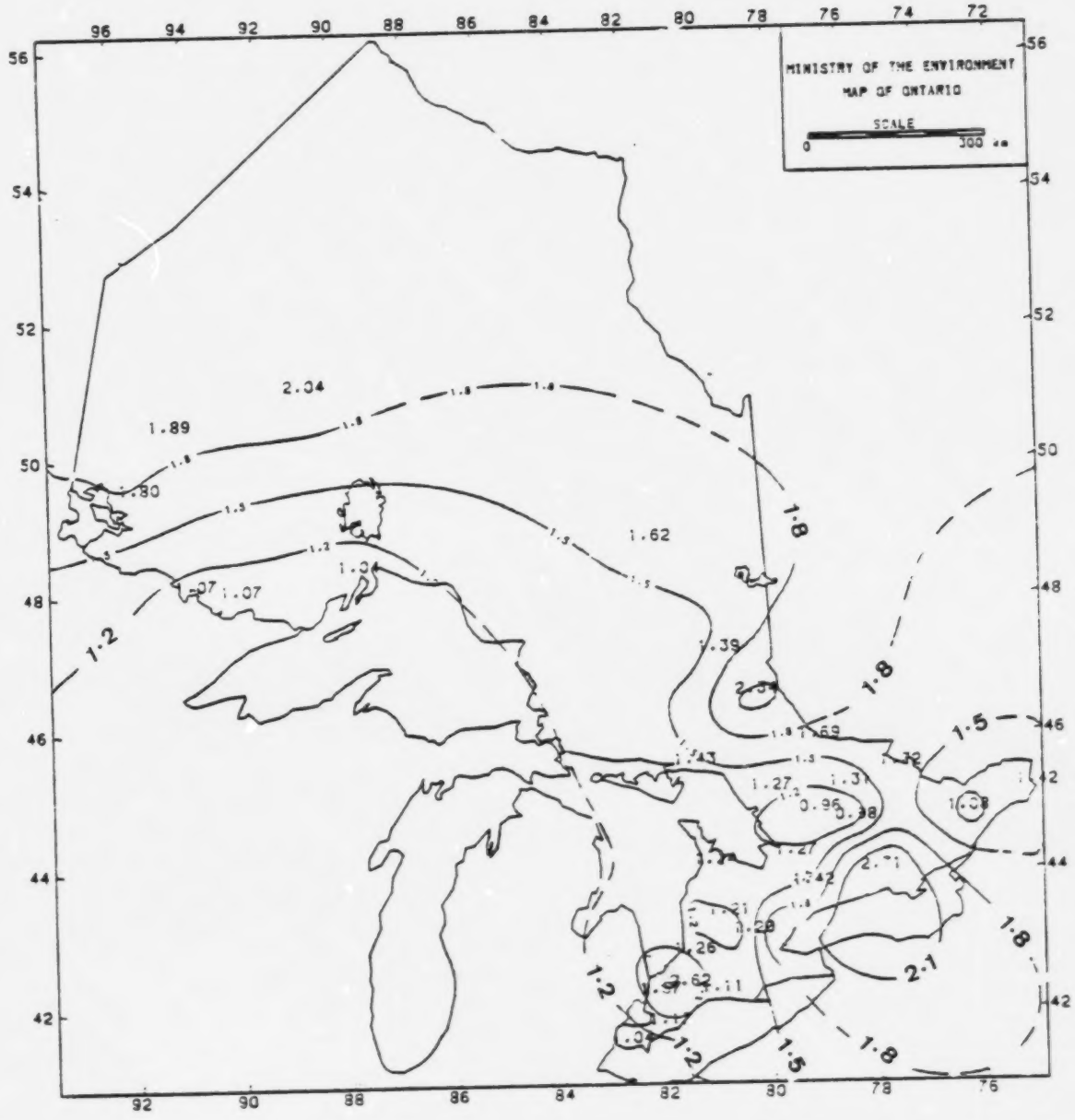


Figure 13a. Annual average precipitation concentration (ug/l) of Cu -1983.

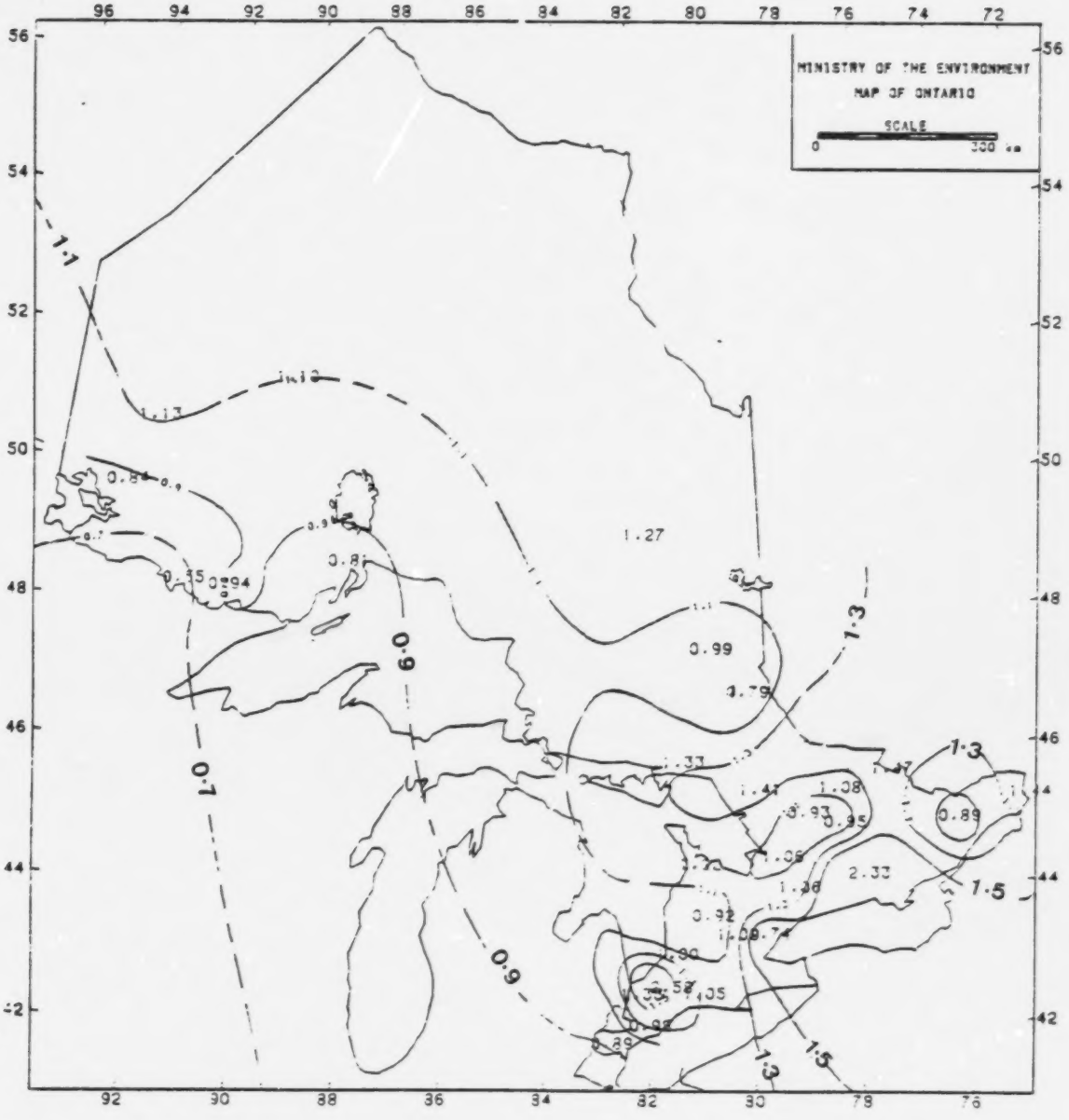


Figure 13b. Annual wet deposition (mg/m^2) of Cu – 1983.

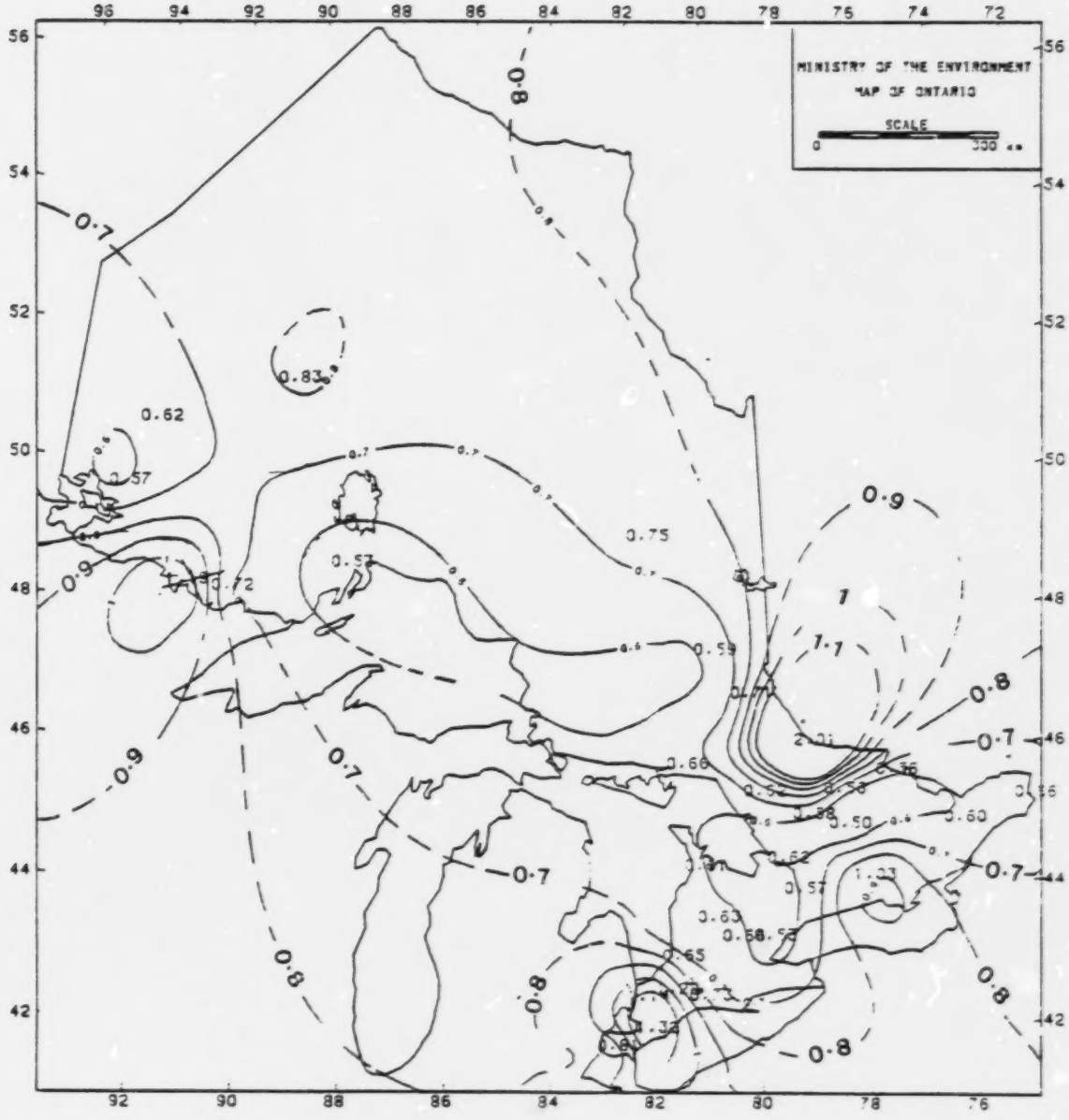


Figure 14a. Annual average precipitation concentration (ug/l) of Ni -1983.

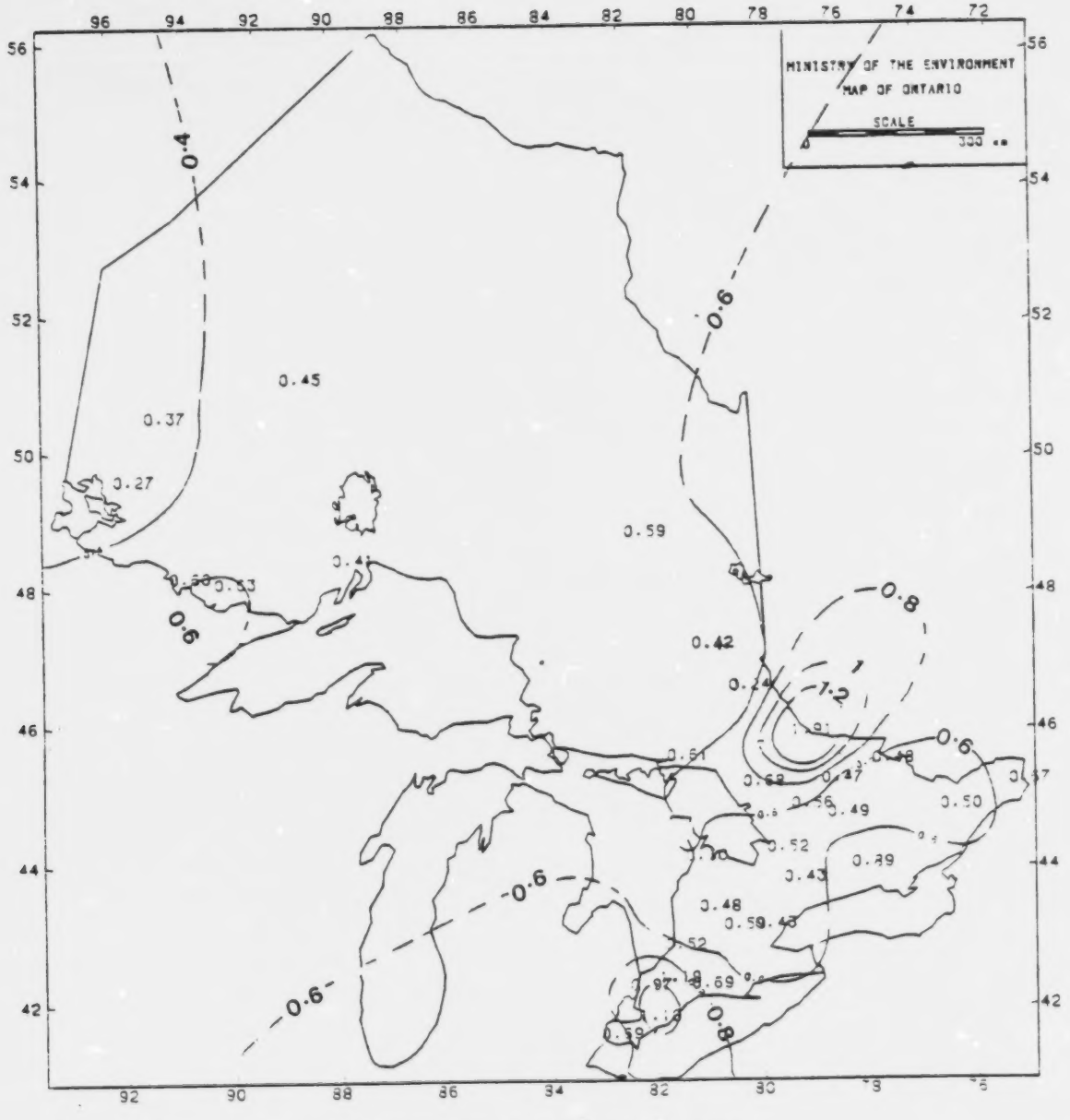


Figure 14b. Annual wet deposition (mg/m^2) of Ni - 1983.

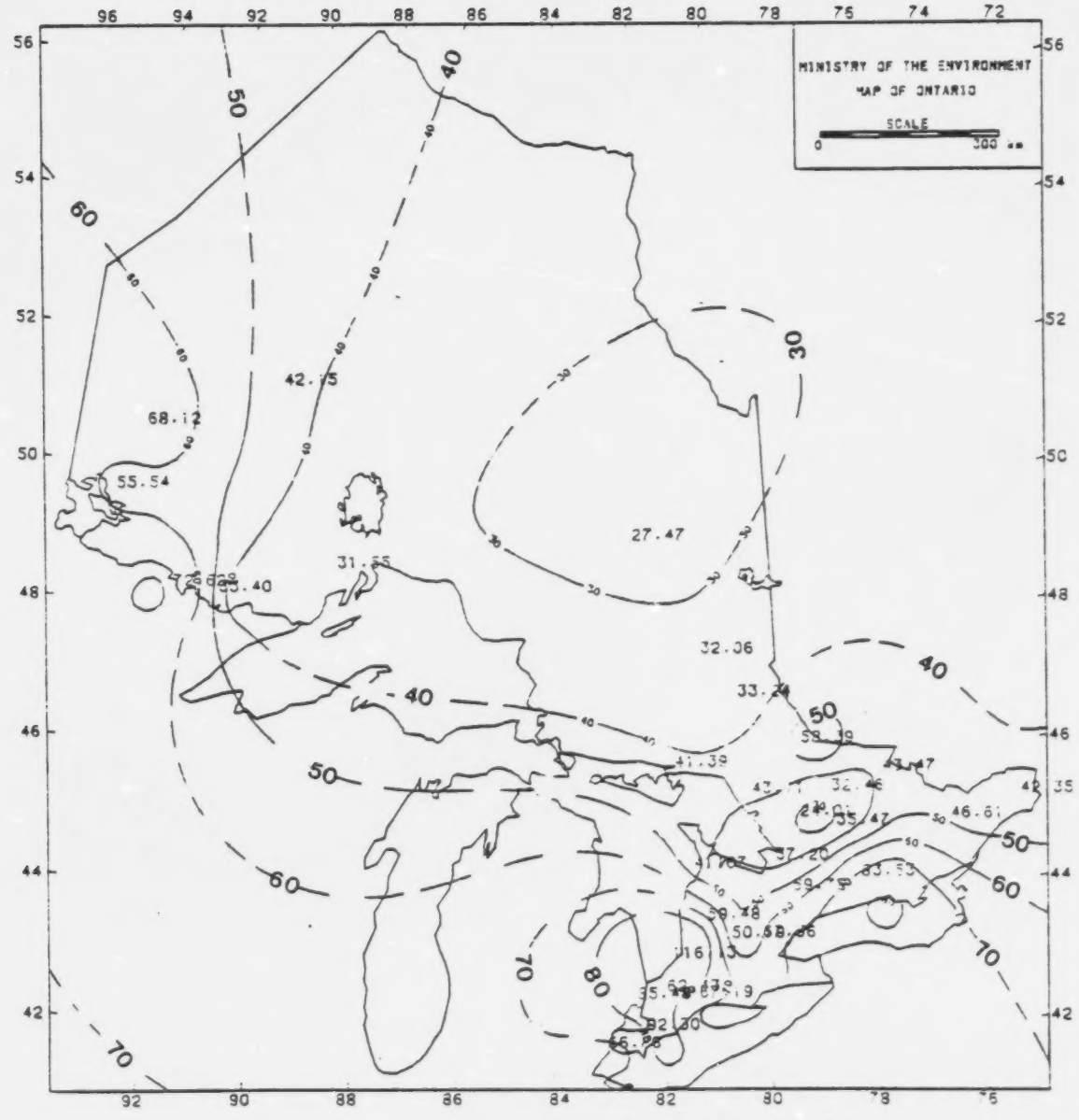


Figure 15a. Annual average precipitation concentration (ug/l) of Fe -1983.

Figure 15b. Annual wet deposition (mg/m^2) of Fe -1983.

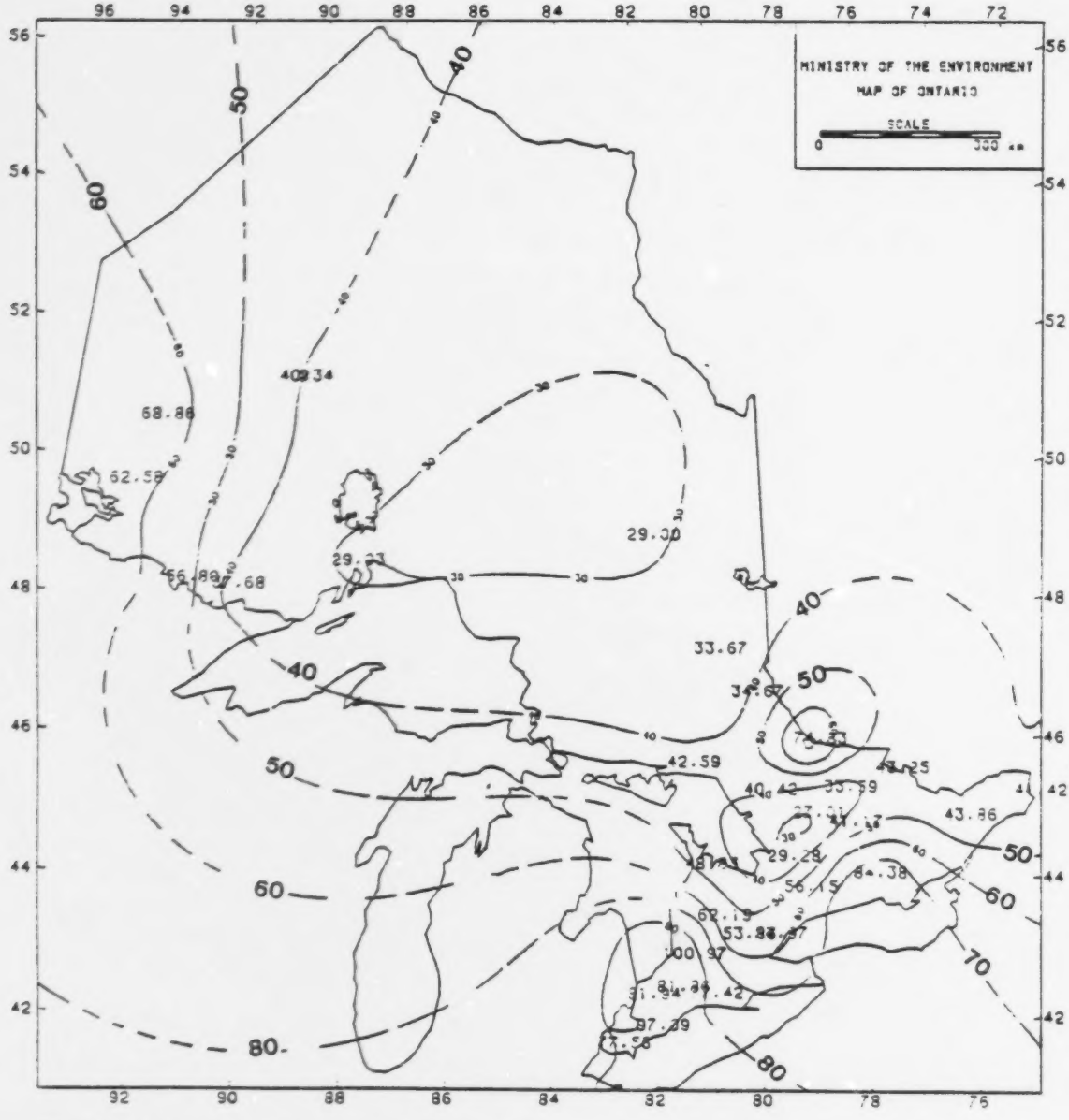


Figure 16a. Annual average precipitation concentration (ug/l) of Al - 1983.

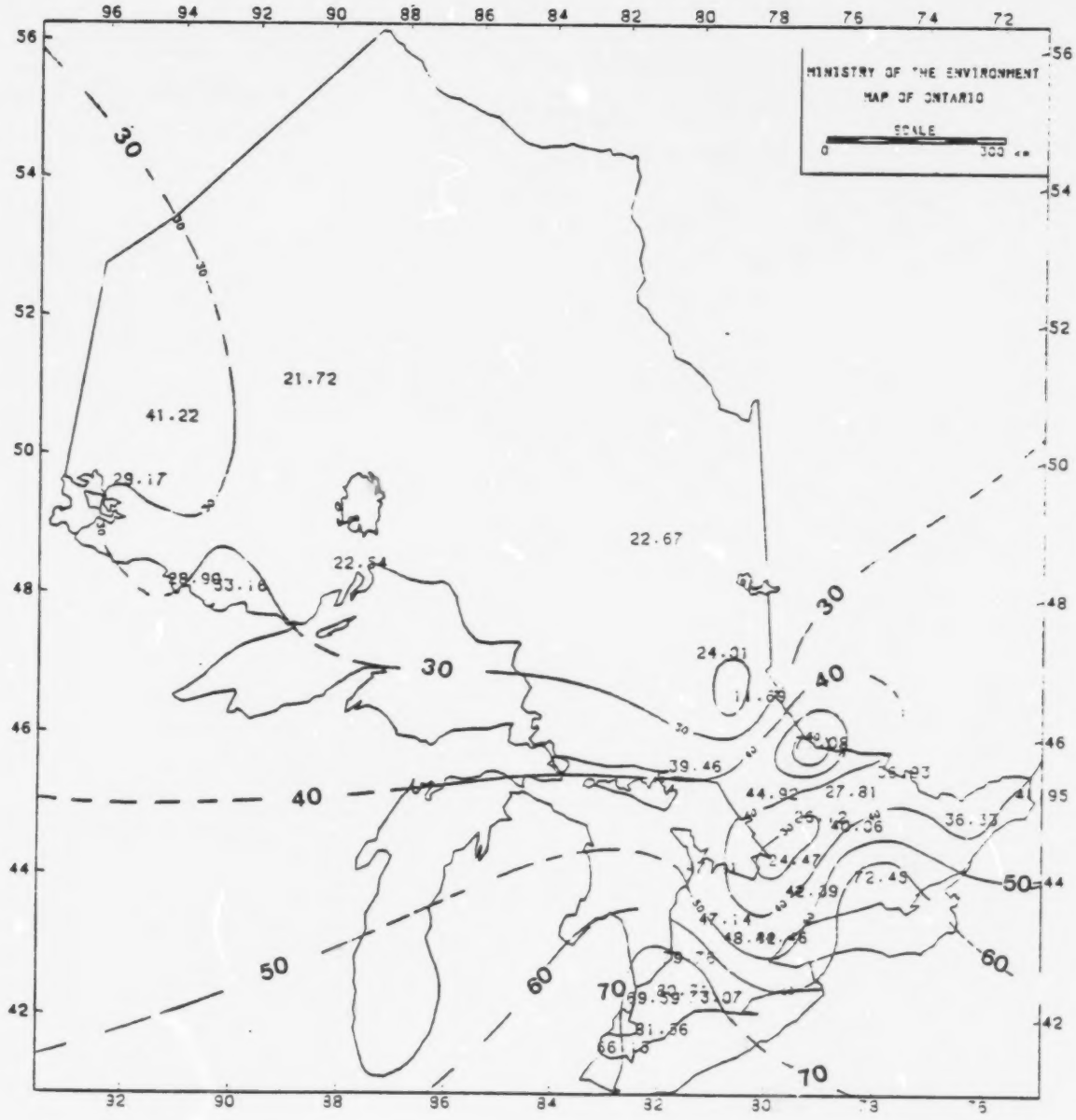


Figure 16b. Annual wet deposition (mg/m^2) of Al - 1983.

Figure 17a. Annual average precipitation concentration (mg/l) of Ca - 1983.

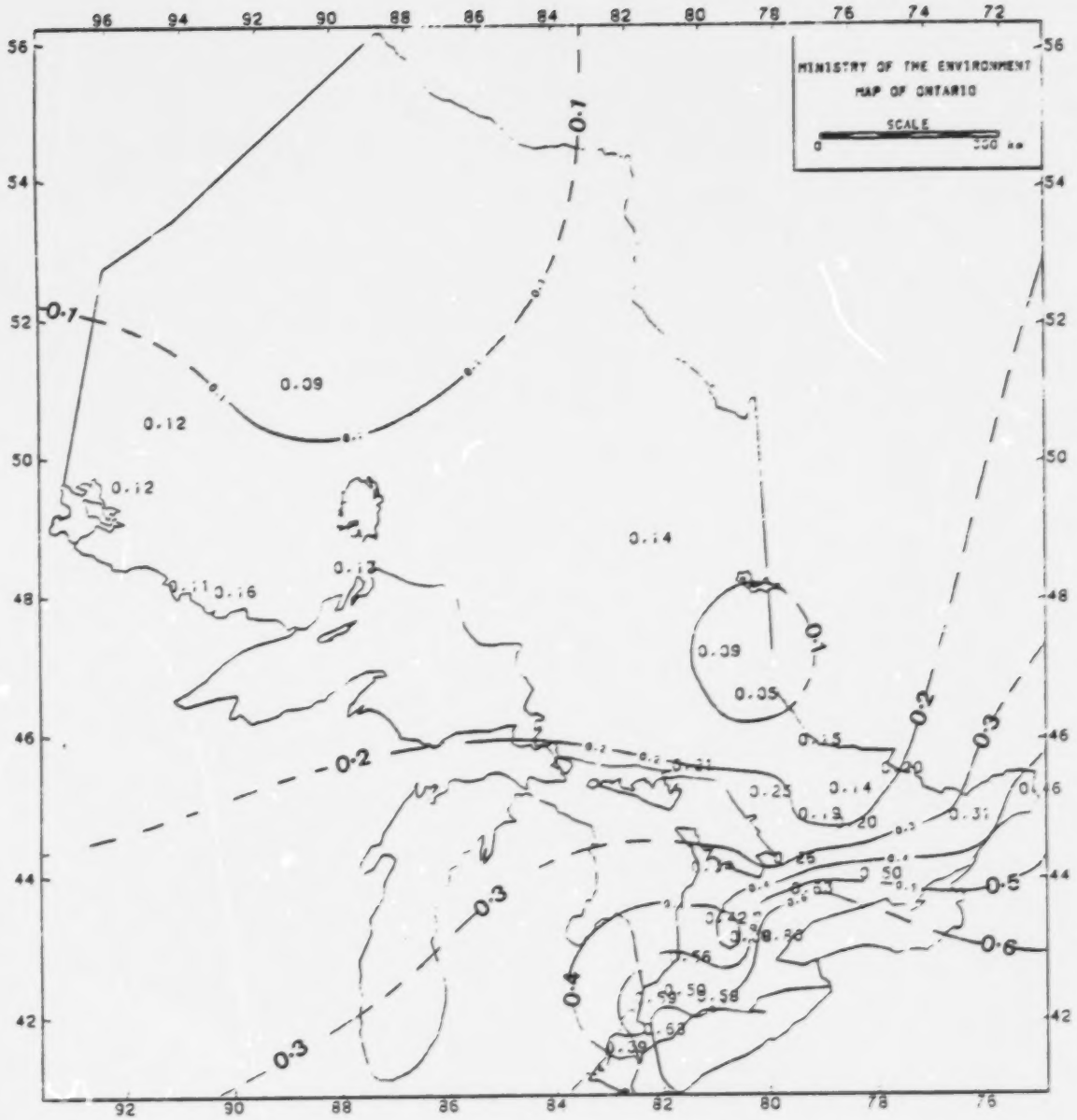


Figure 17b. Annual wet deposition (g/m^2) of Ca - 1983.

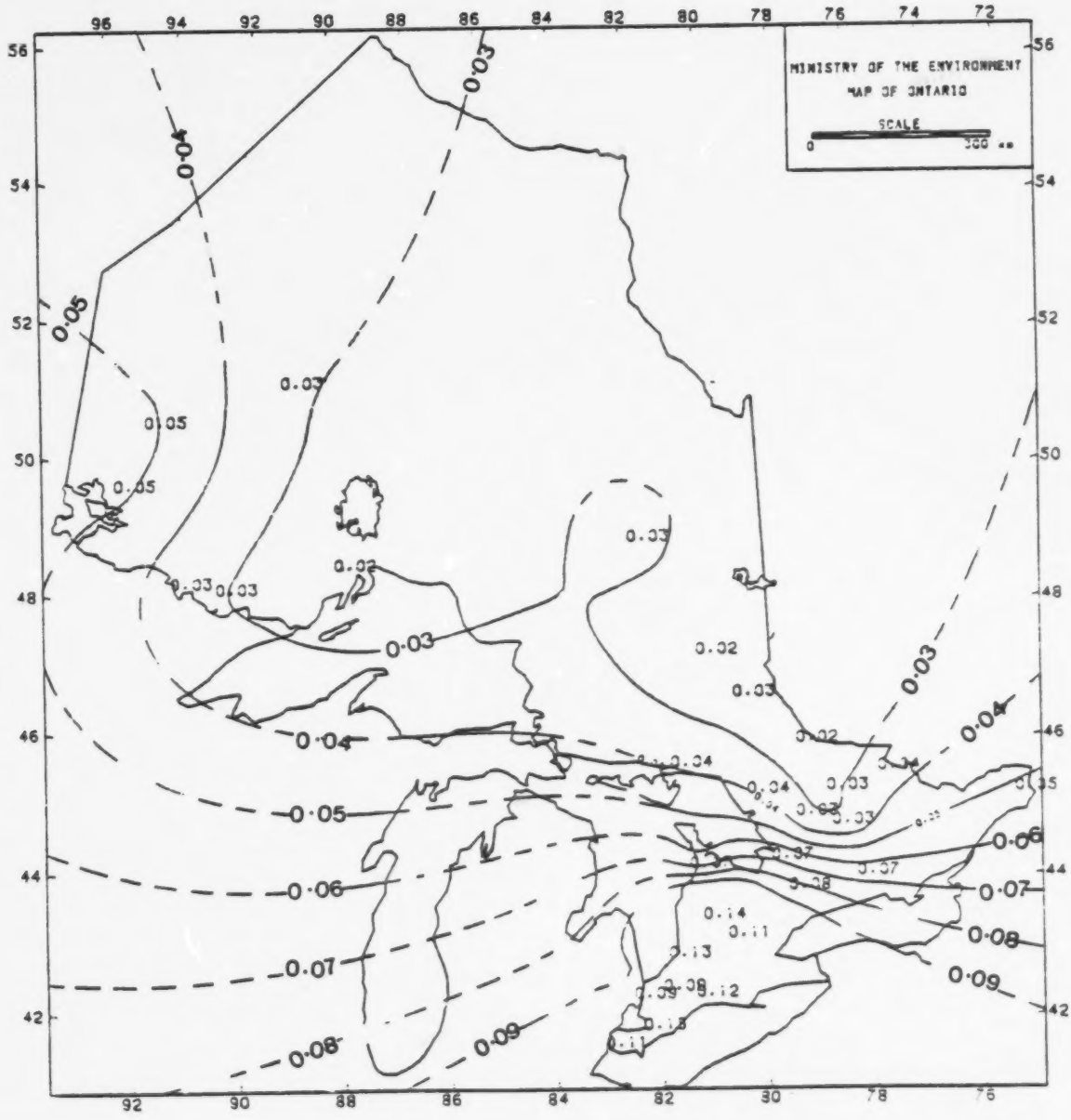


Figure 18a. Annual average precipitation concentration (mg/l) of Mg - 1983.

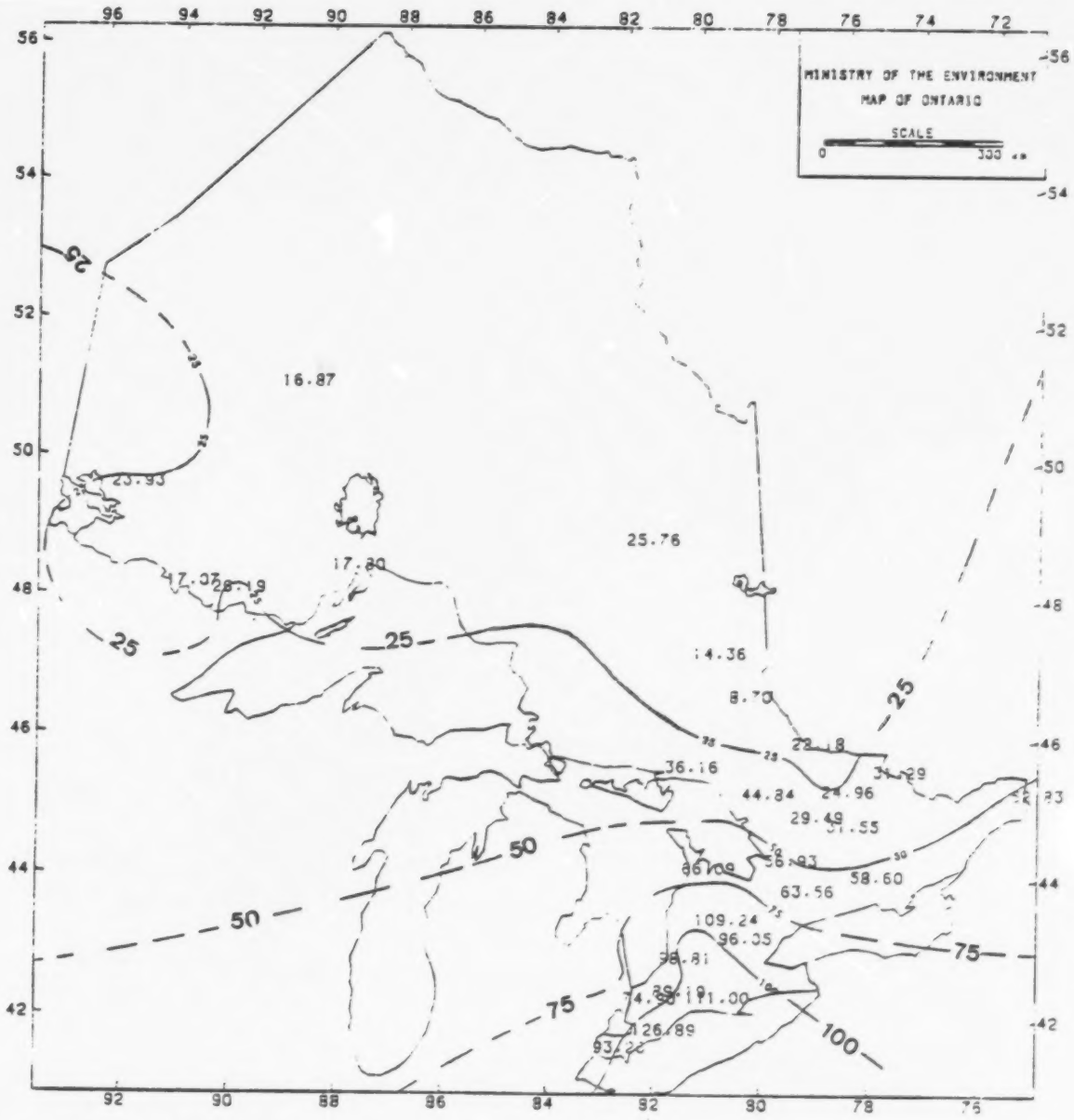


Figure 18b. Annual wet deposition (mg/m^2) of Mg - 1983.

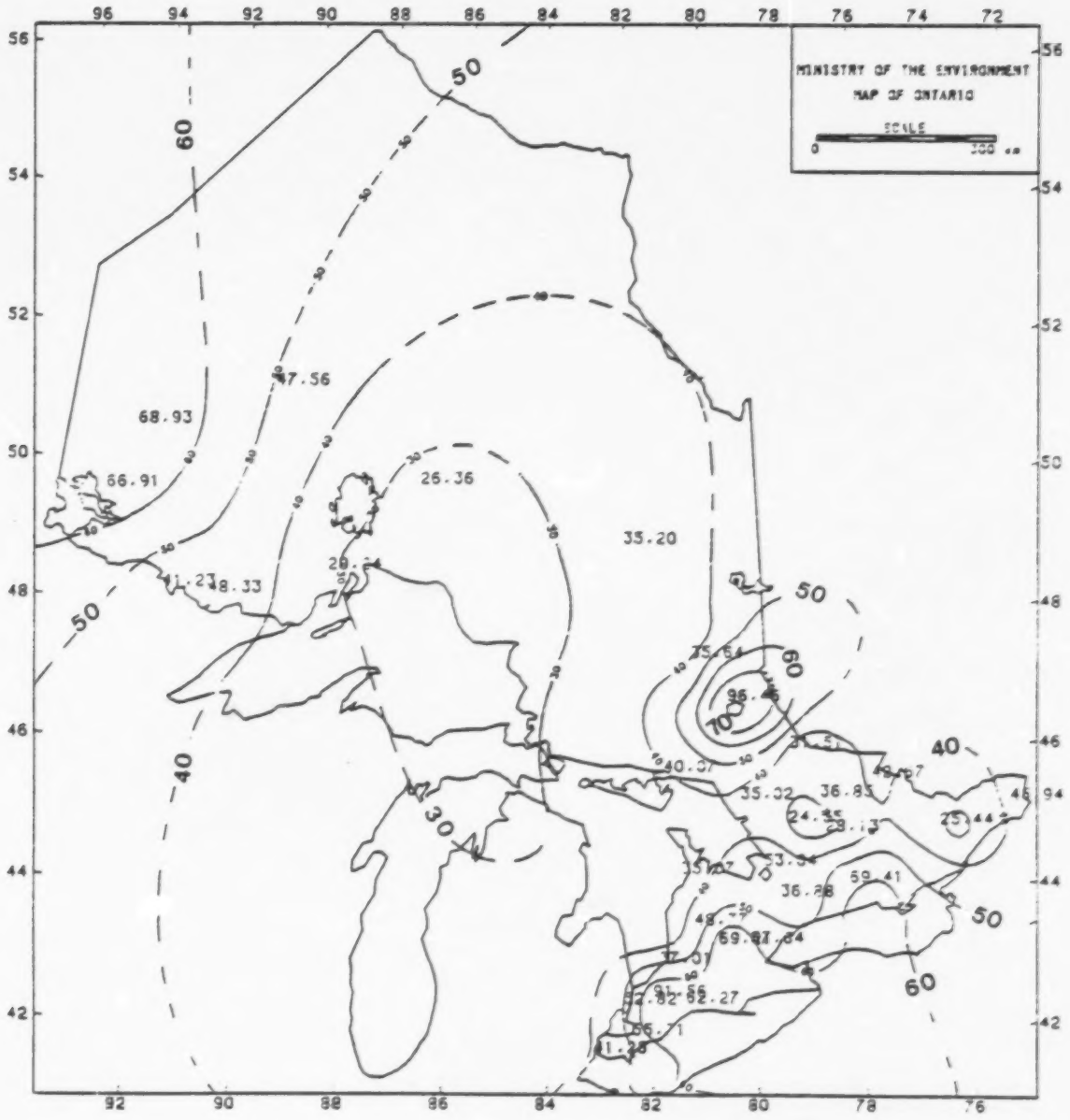


Figure 19a. Annual average air concentration (ug/l) of K - 1983.

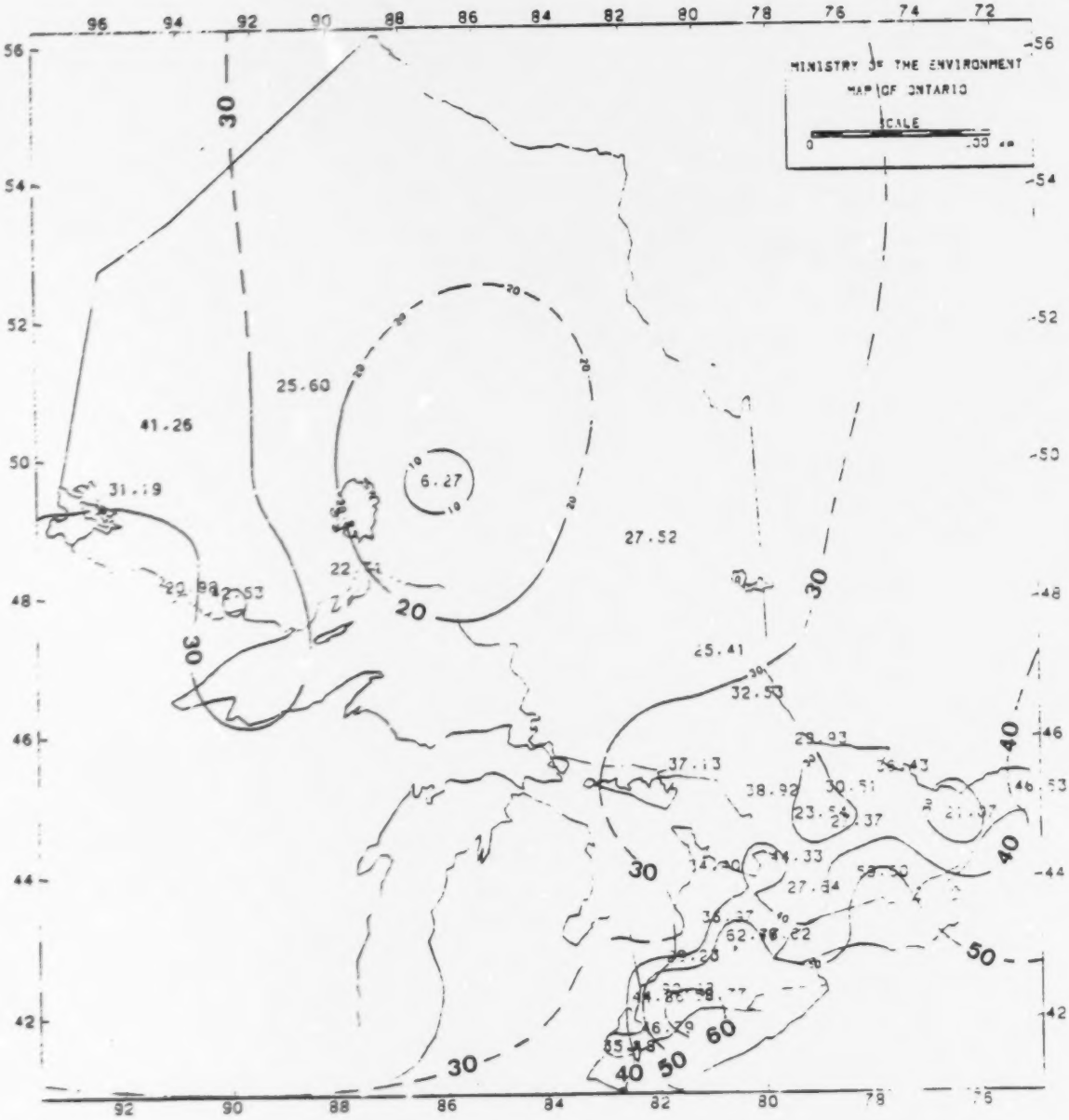


Figure 19b. Annual wet deposition (mg/m^2) of K - 1983.

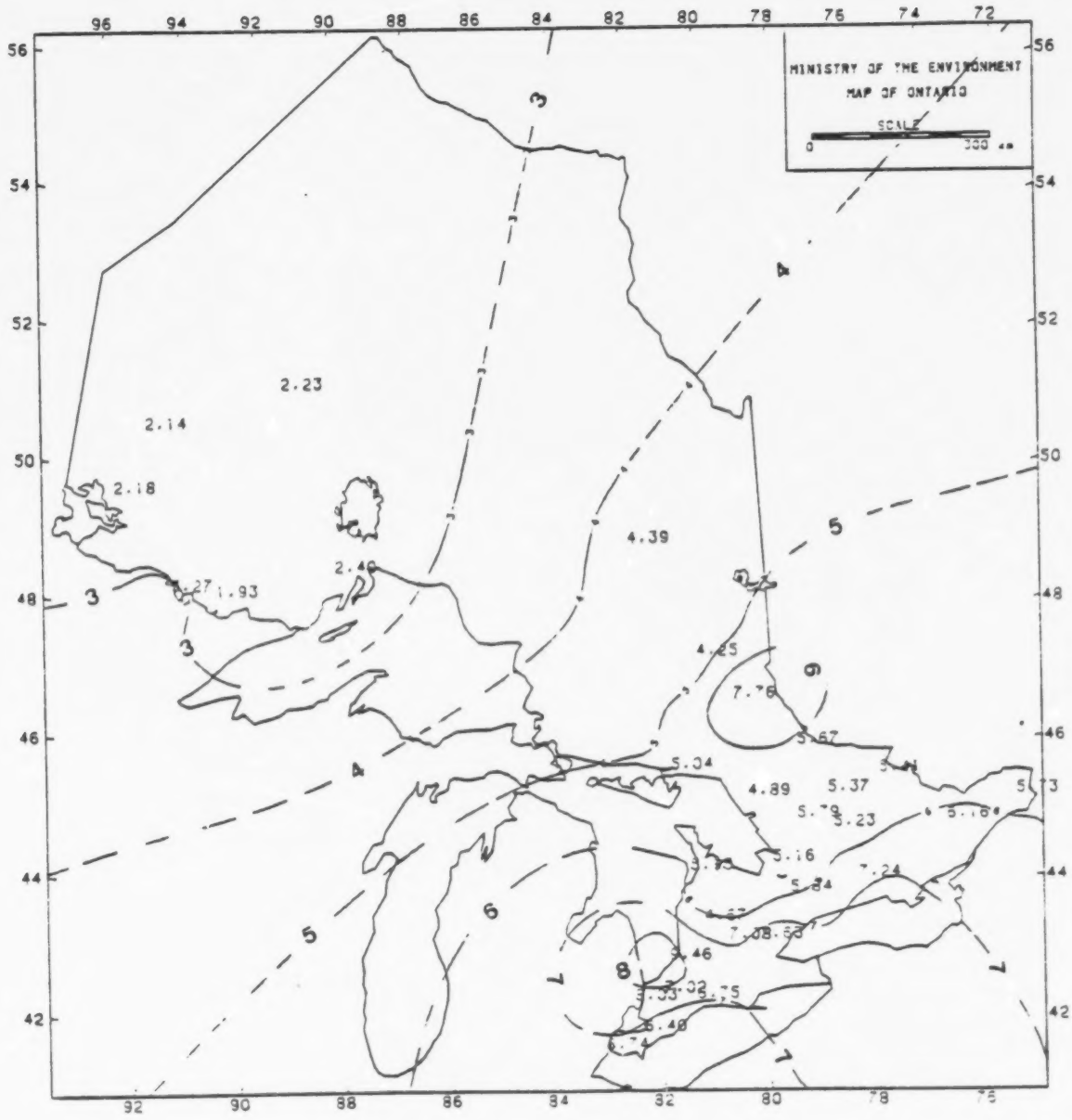
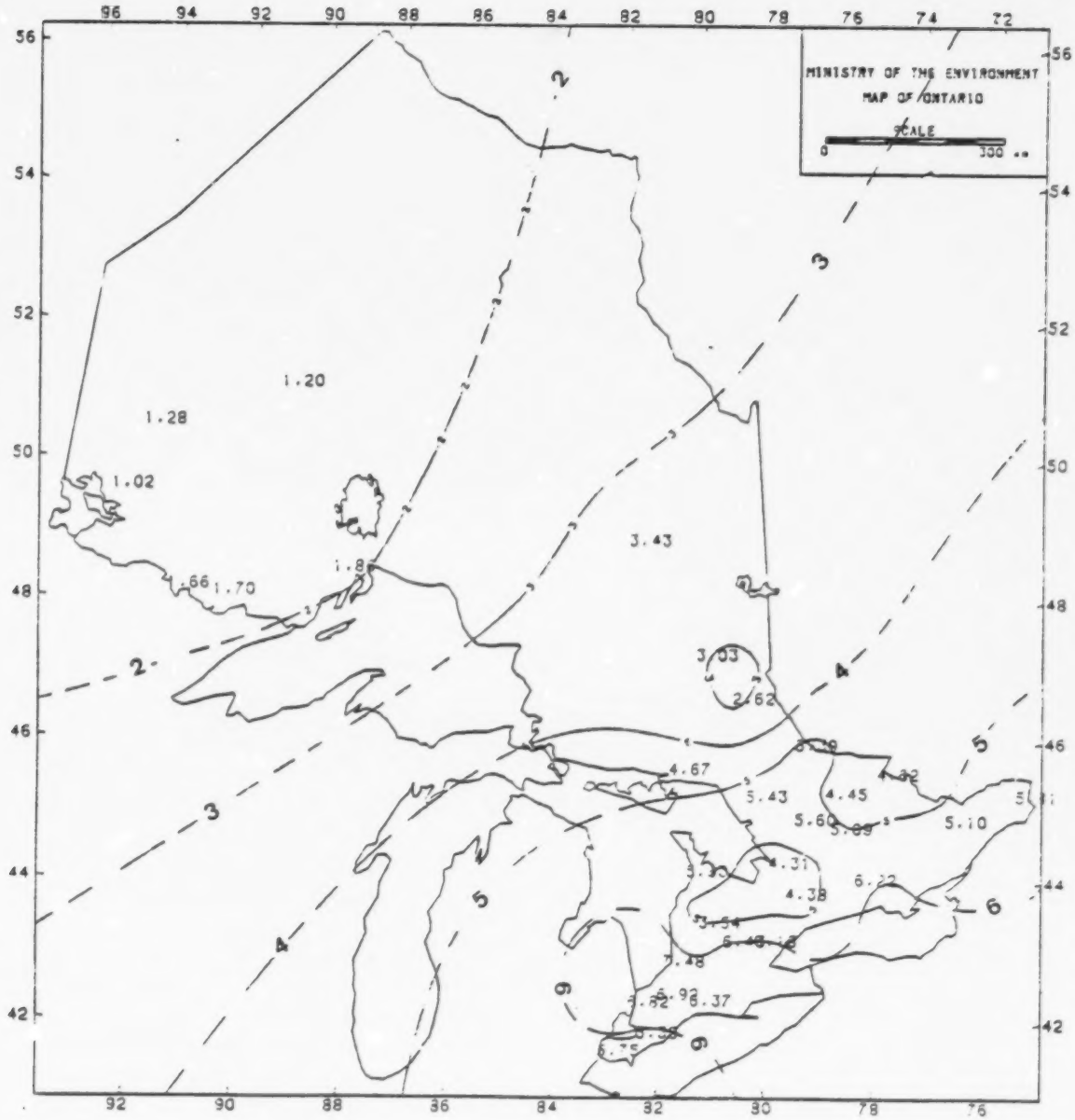


Figure 20a. Annual average air concentration (ug/l) of Pb - 1983.



Figur 20b. Annual wet deposition (mg/m^2) of Pb - 1983.

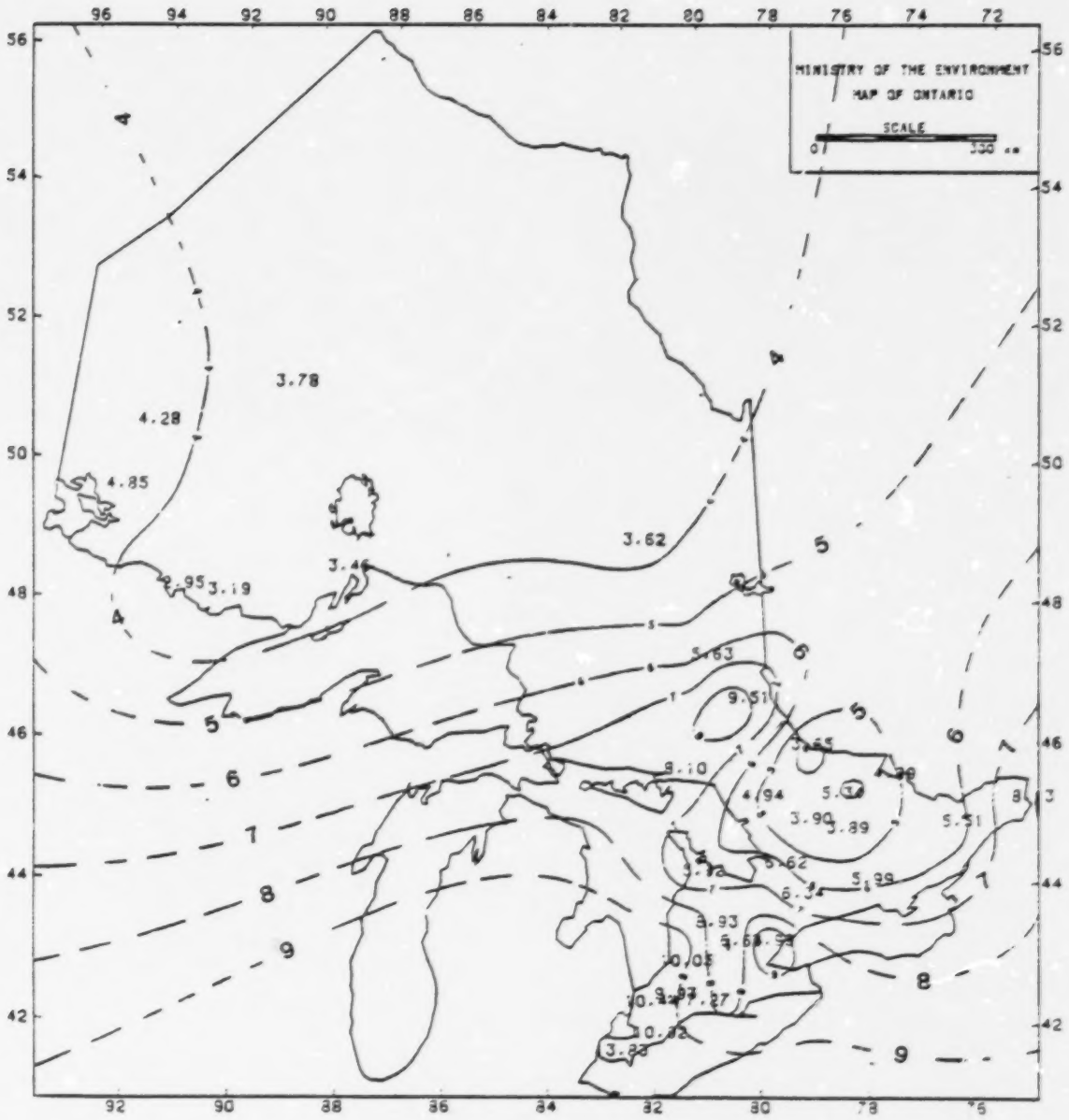


Figure 21a. Annual average air concentration (ug/l) of Zn - 1983.

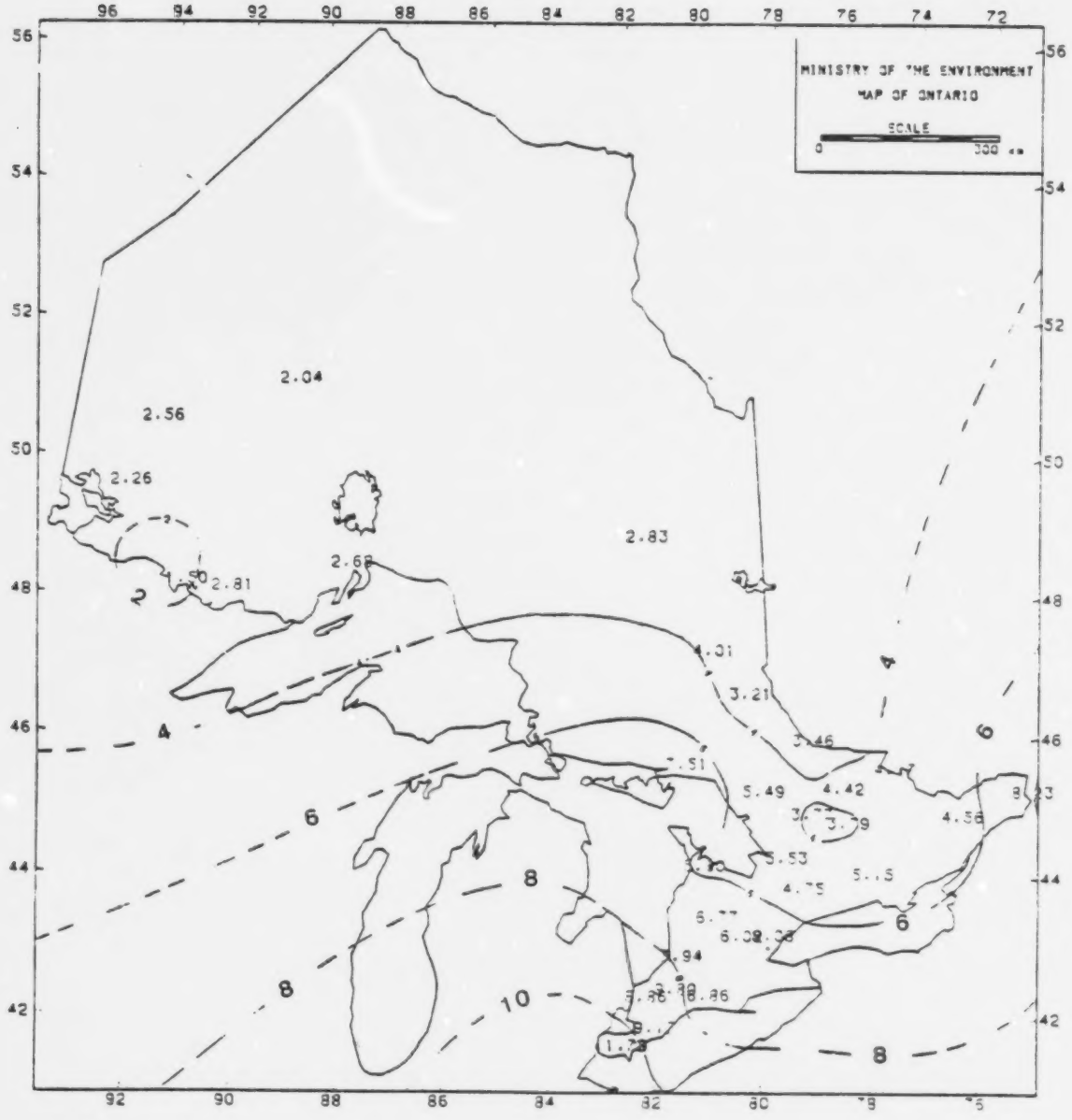


Figure 21b. Annual wet deposition (mg/m^2) of Zn - 1983.

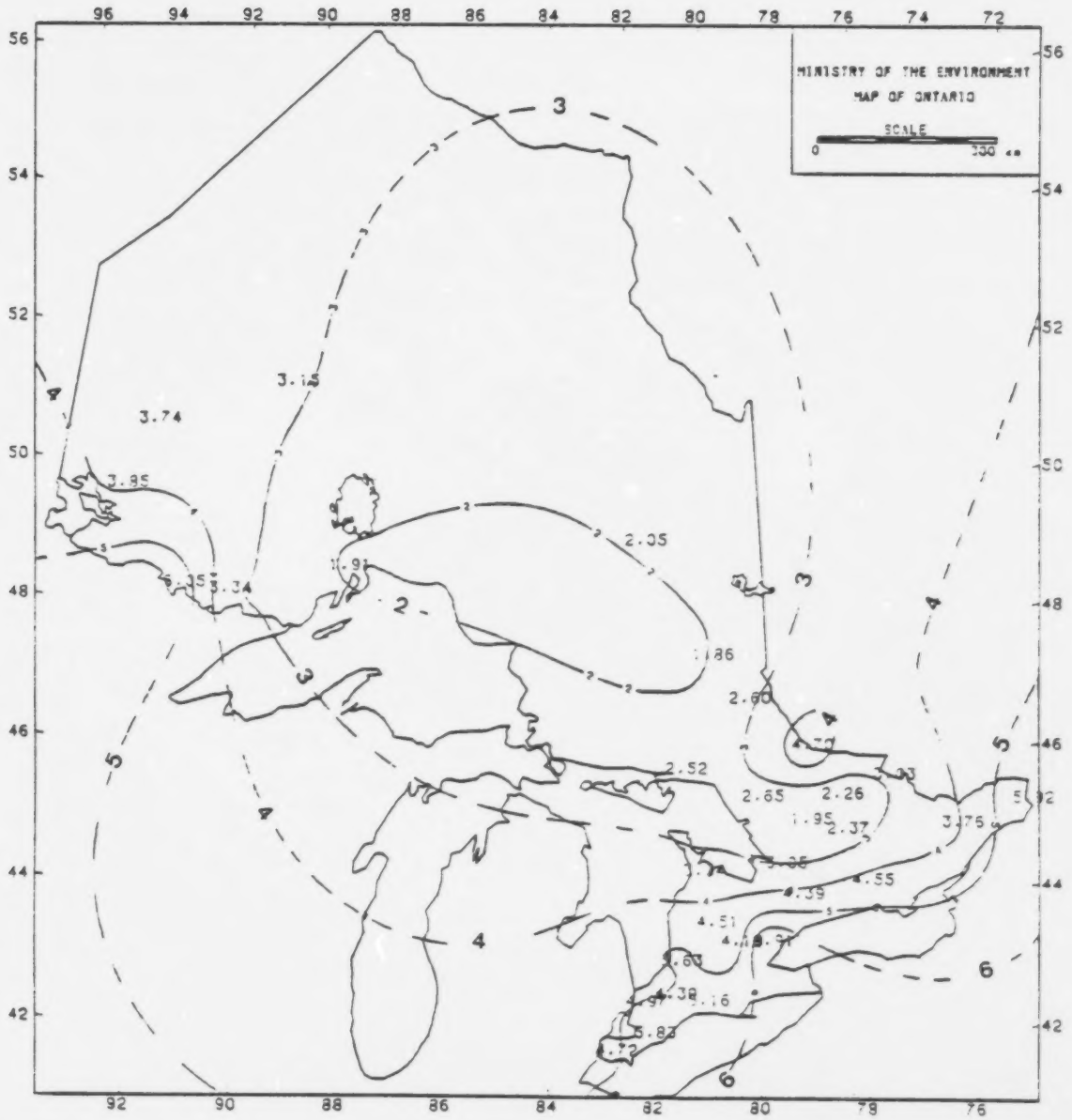


Figure 22a. Annual average air concentration (ug/l) of Mn - 1983.

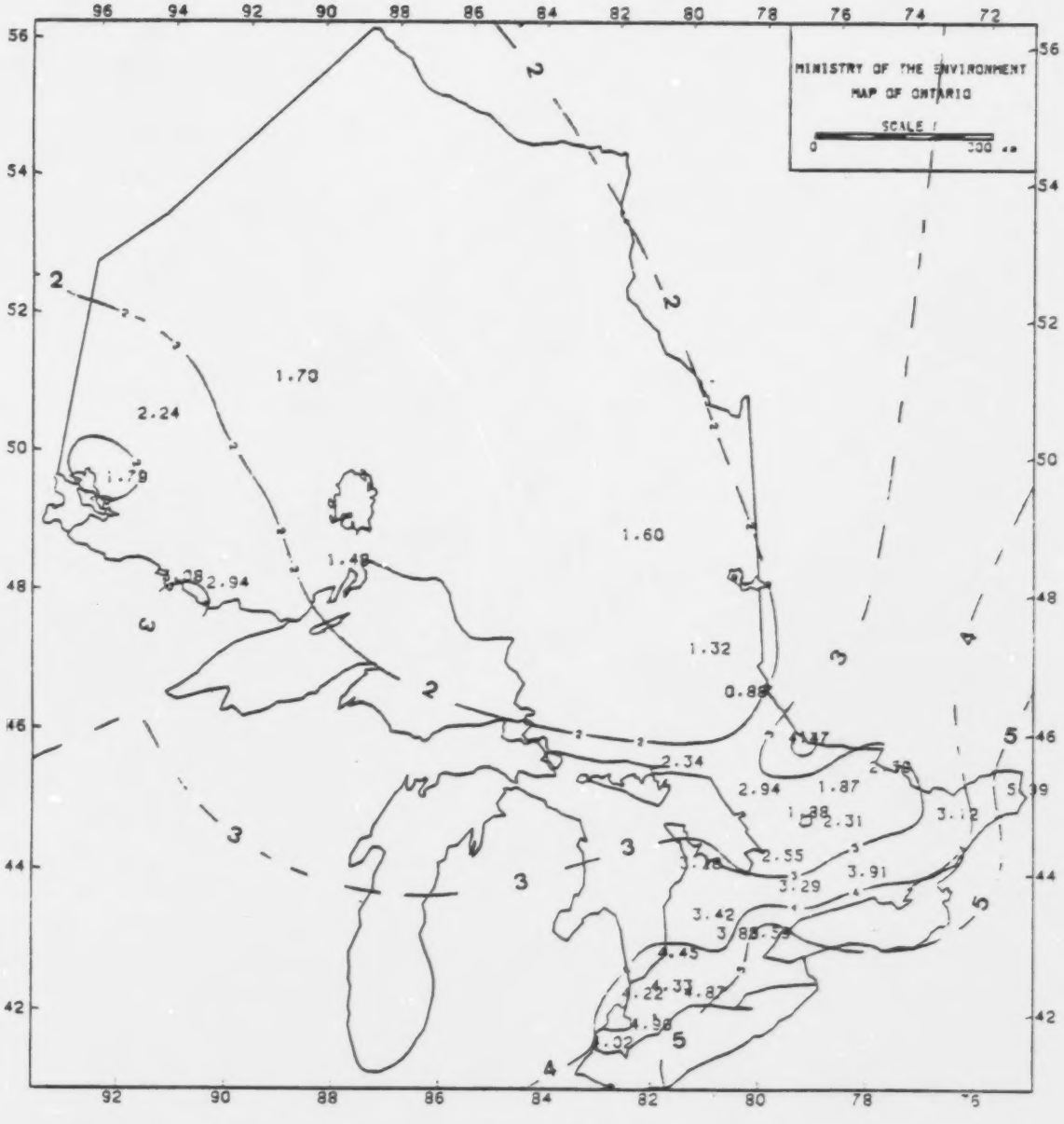


Figure 22b. Annual wet deposition (mg/m^2) of Mn - 1983.

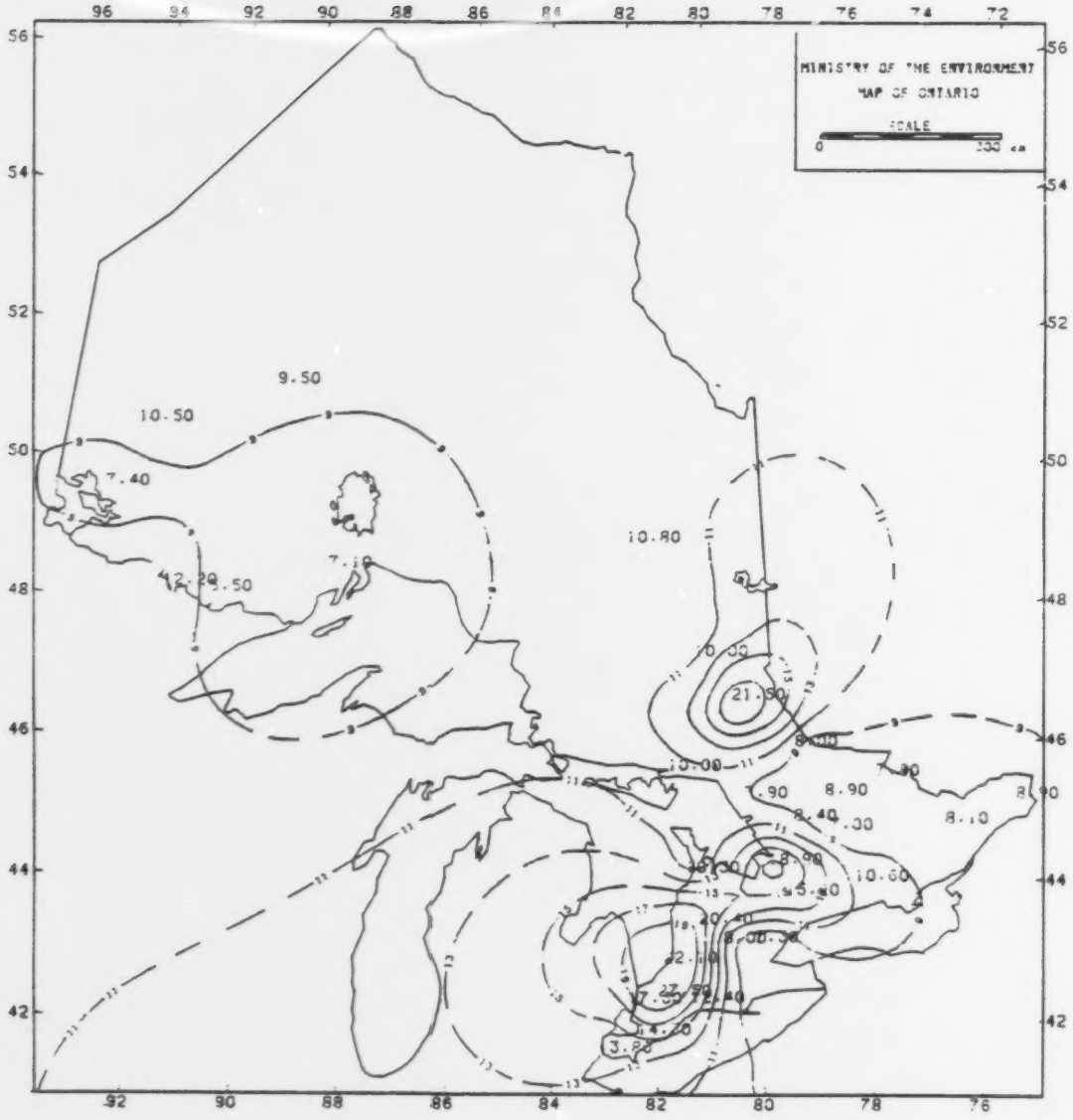


Figure 23a. Annual Average Precipitation Concentration (10^{-2} ug/l) of Cd - 1983.

Figure 23b. Annual wet deposition (ug/m^2) of Cd - 1983.

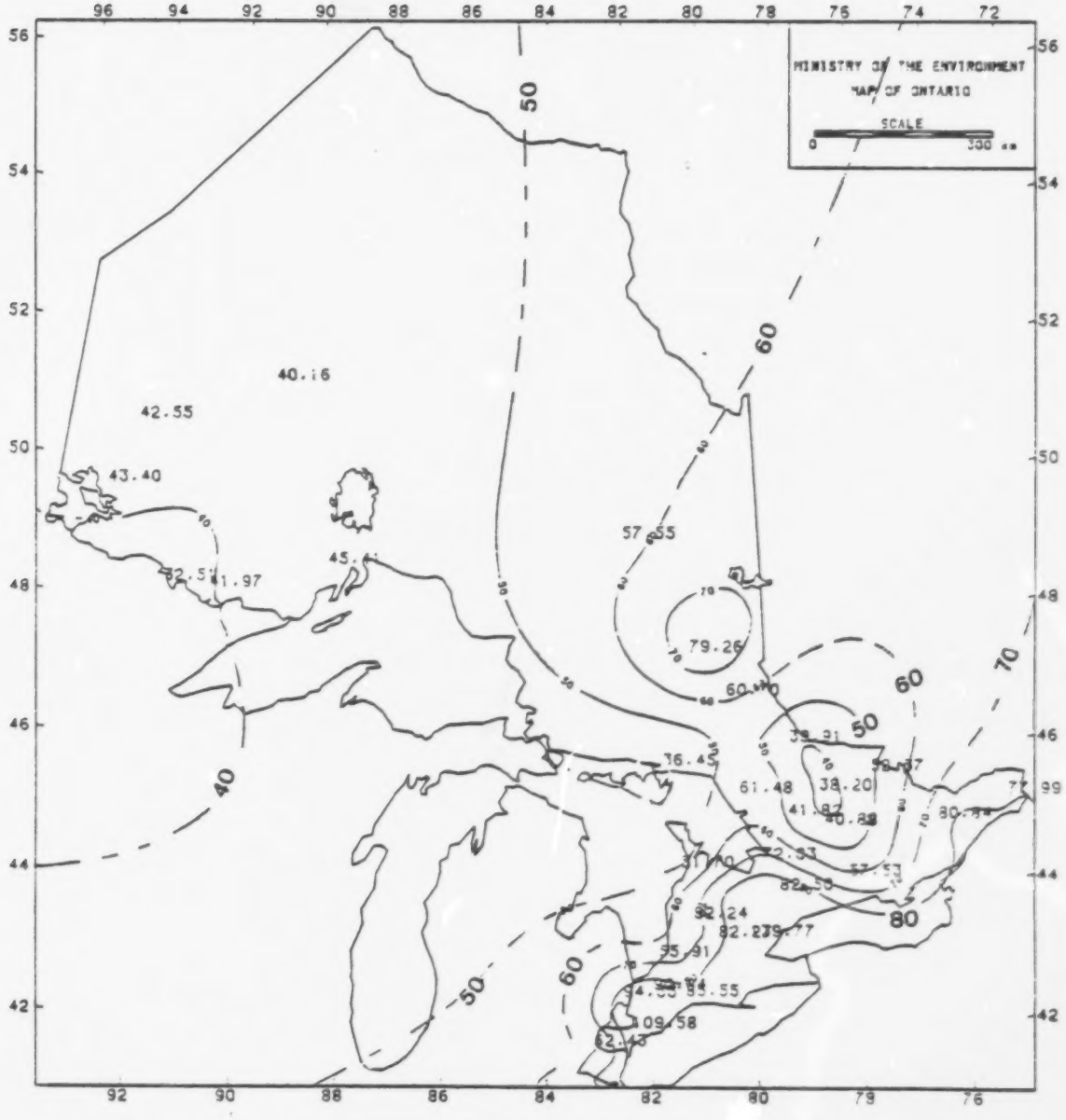


Figure 24a. Annual average precipitation concentration (ug/l) of Na - 1983.

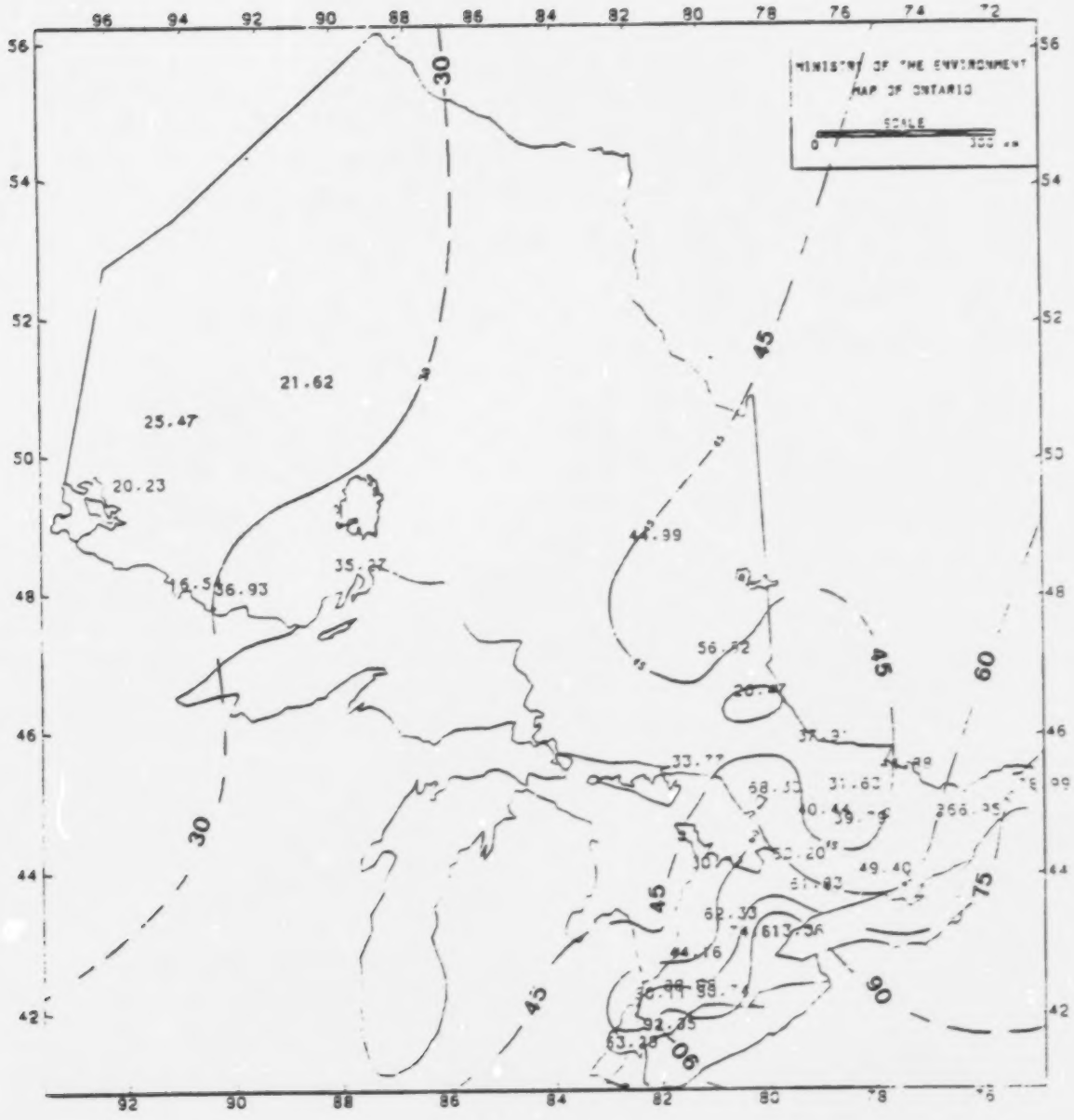


Figure 24b. Annual wet deposition (mg/m^2) of Na - 1983.

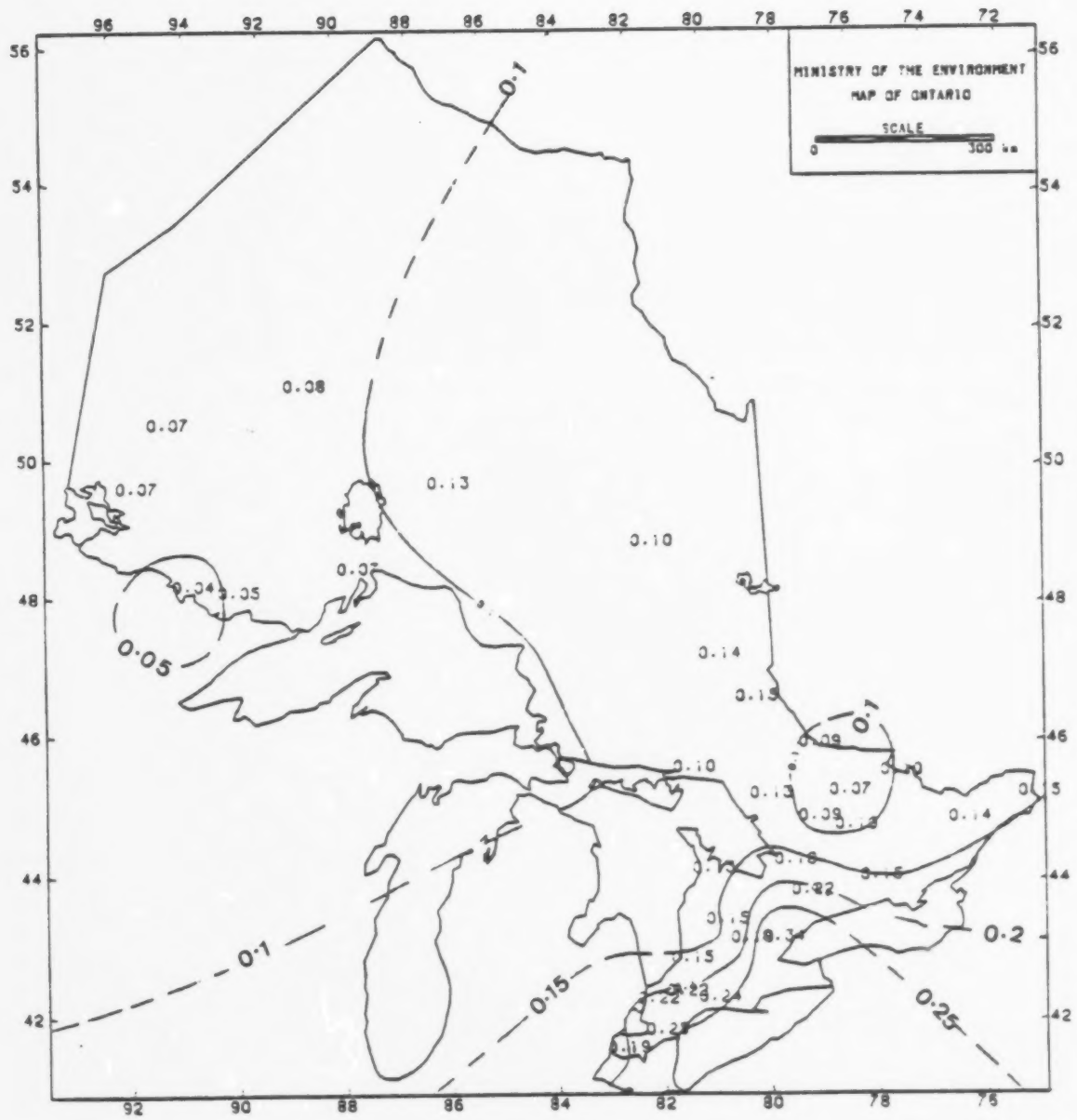


Figure 25a. Annual average precipitation (mg/l) of Cl - 1983.

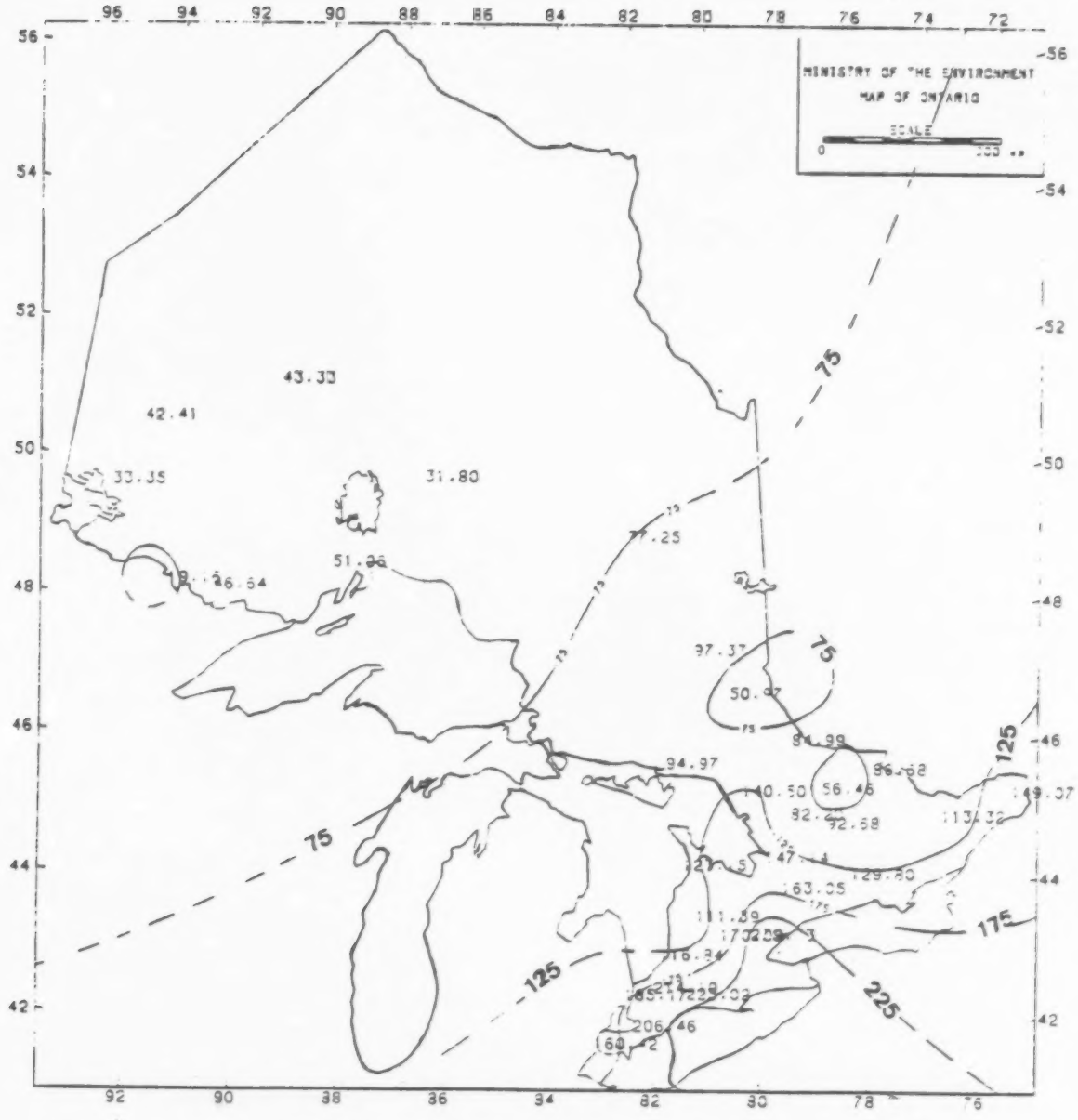


Figure 25b. Annual wet deposition (mg/m^2) of Cl - 1983.

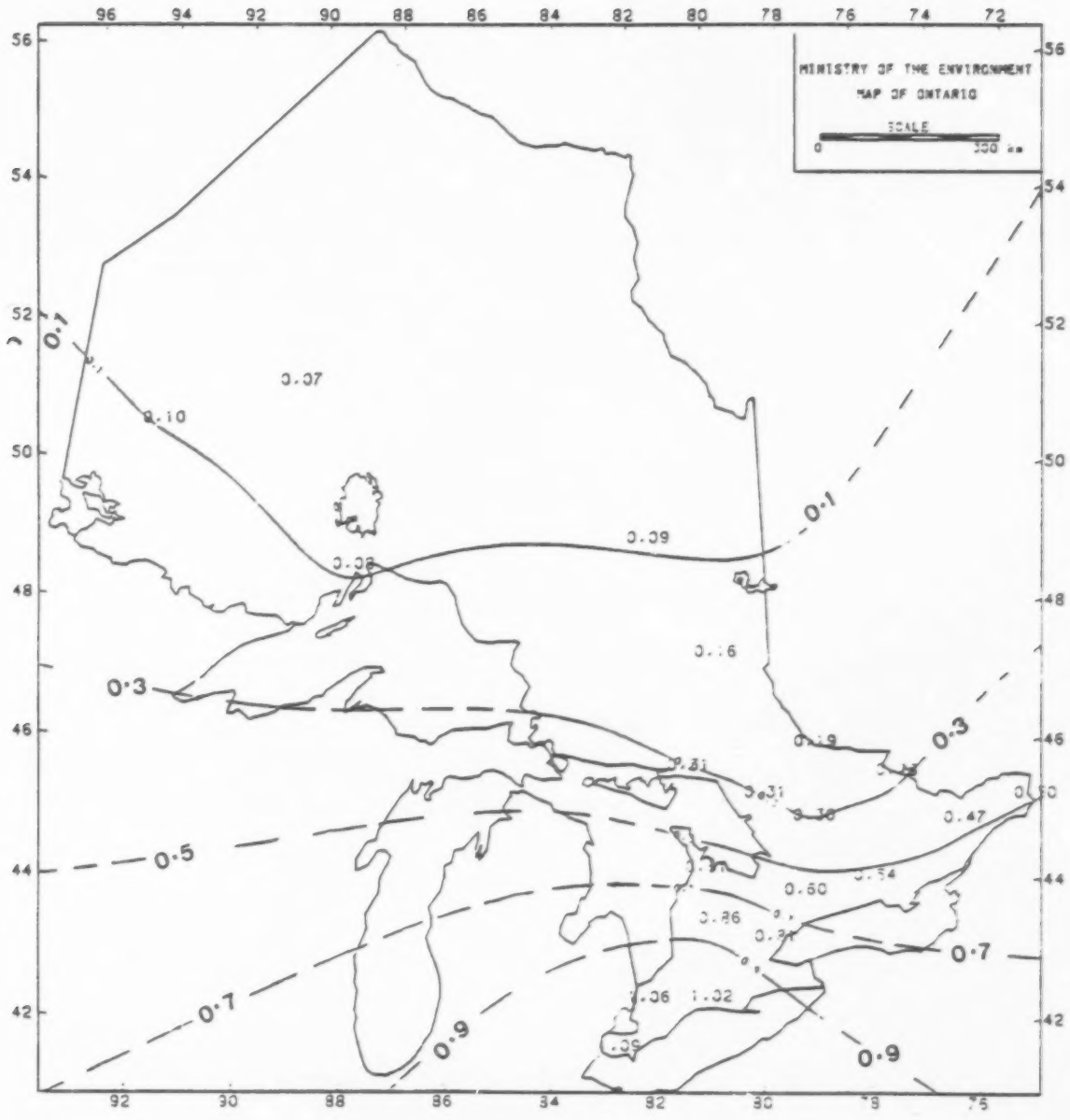


Figure 26. Annual average air concentration (ug/m^3) of N-NO_3 - 1983.

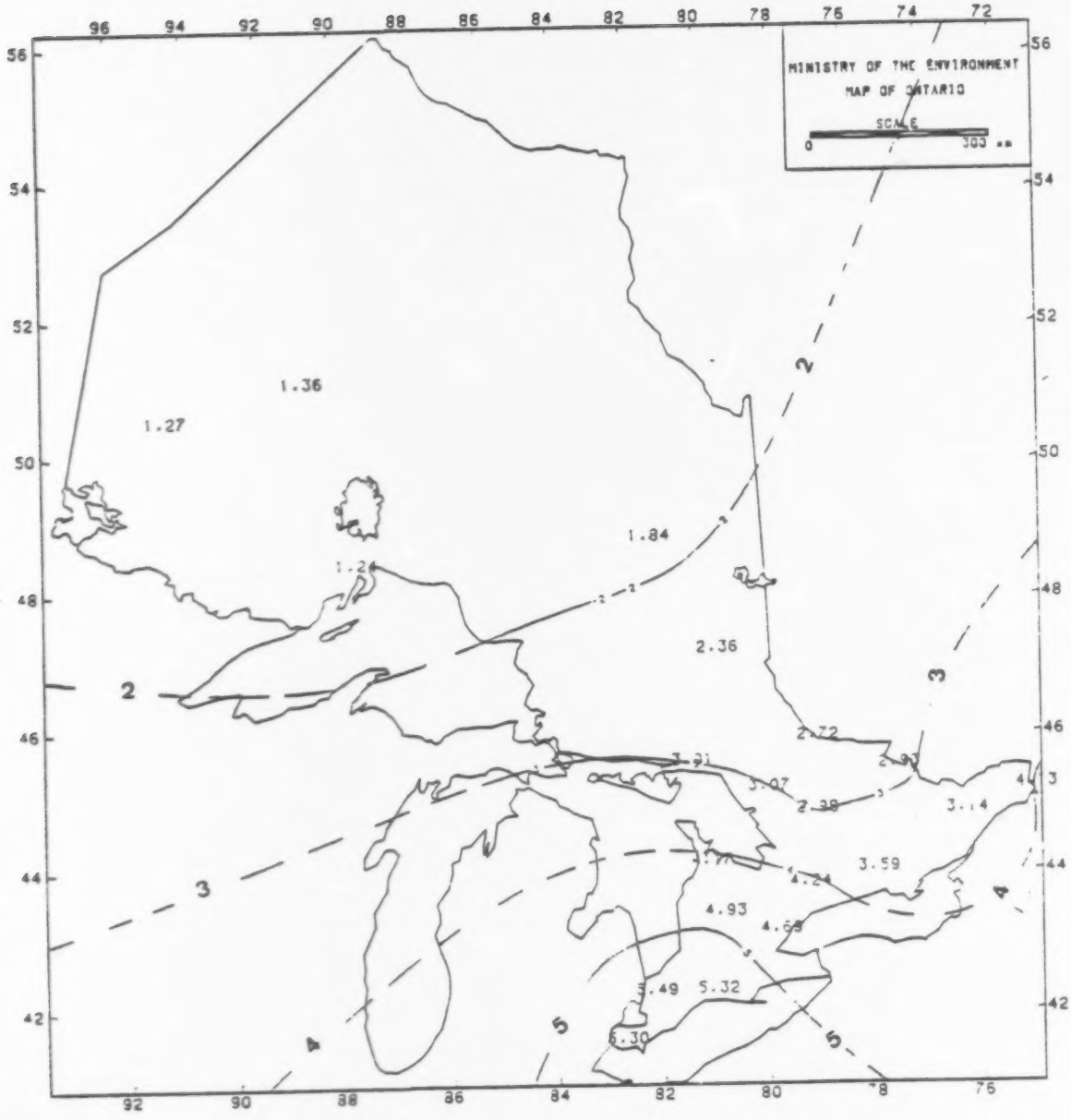


Figure 27. Annual average air concentration (ug/m^3) of SO_4 - 1983.

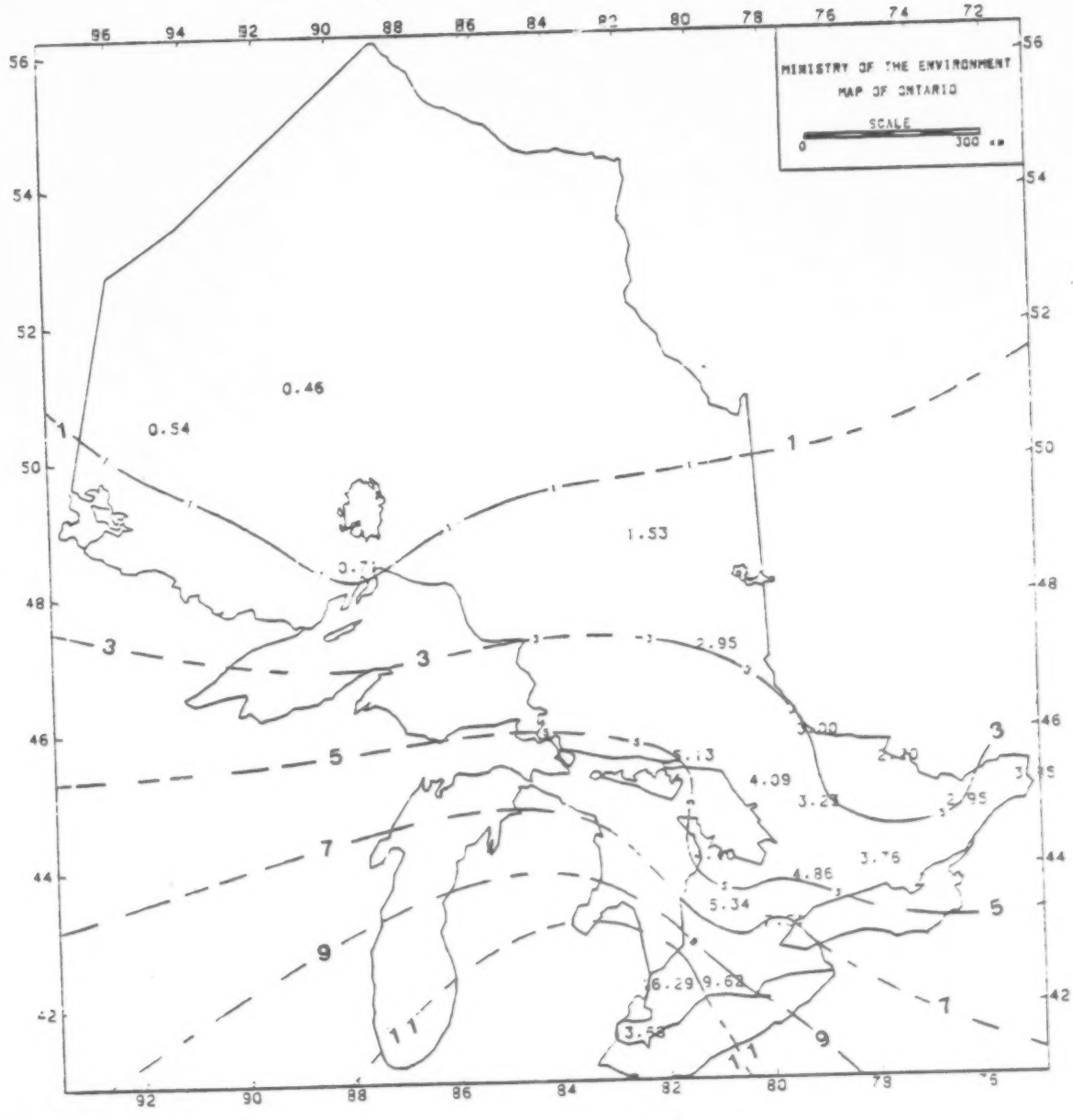


Figure 28. Annual average air concentration (ug/m^3) of SO_2 - 1983.

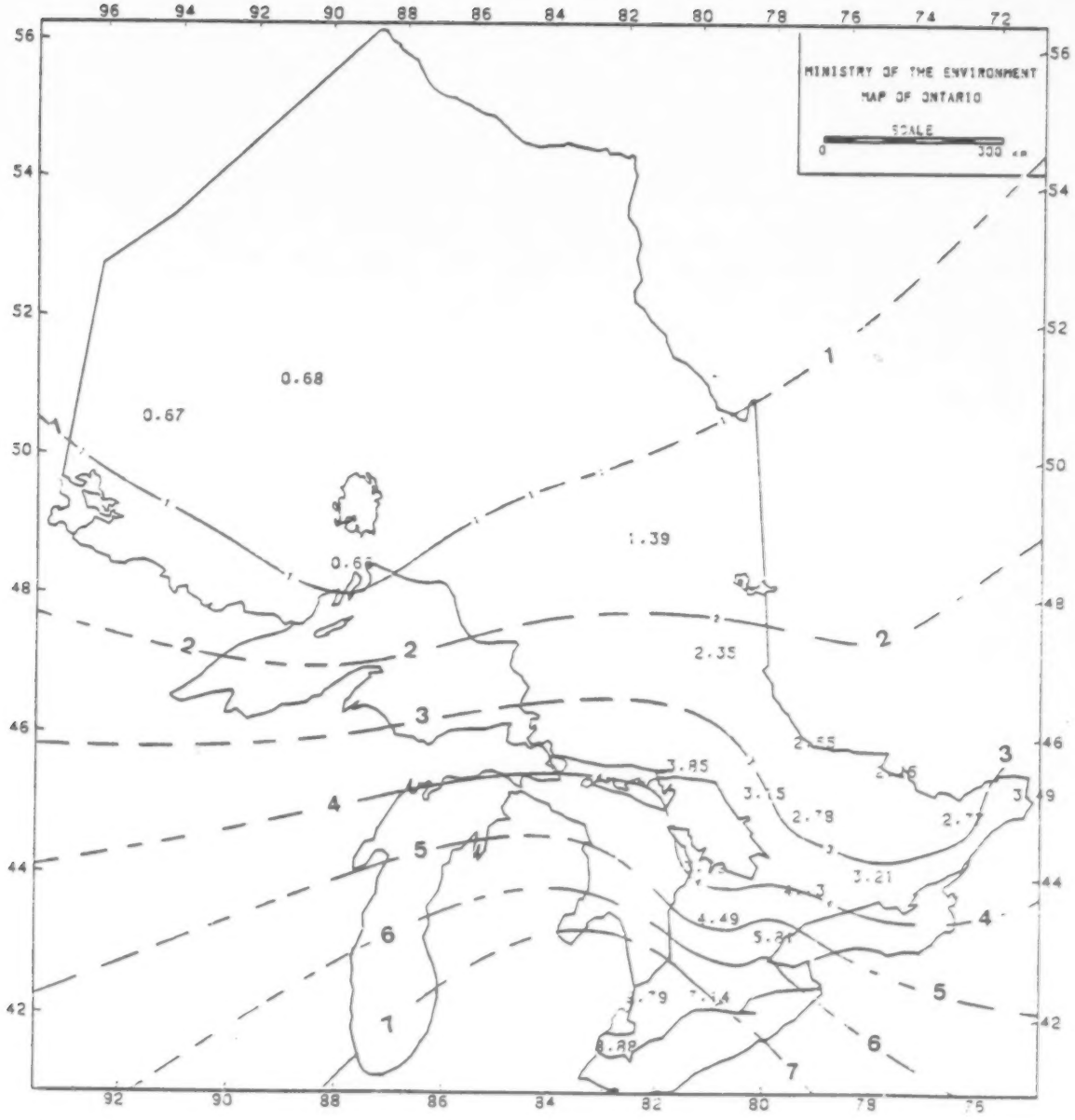


Figure 29. Annual average air concentration (ug/m^3) of total S - 1983.

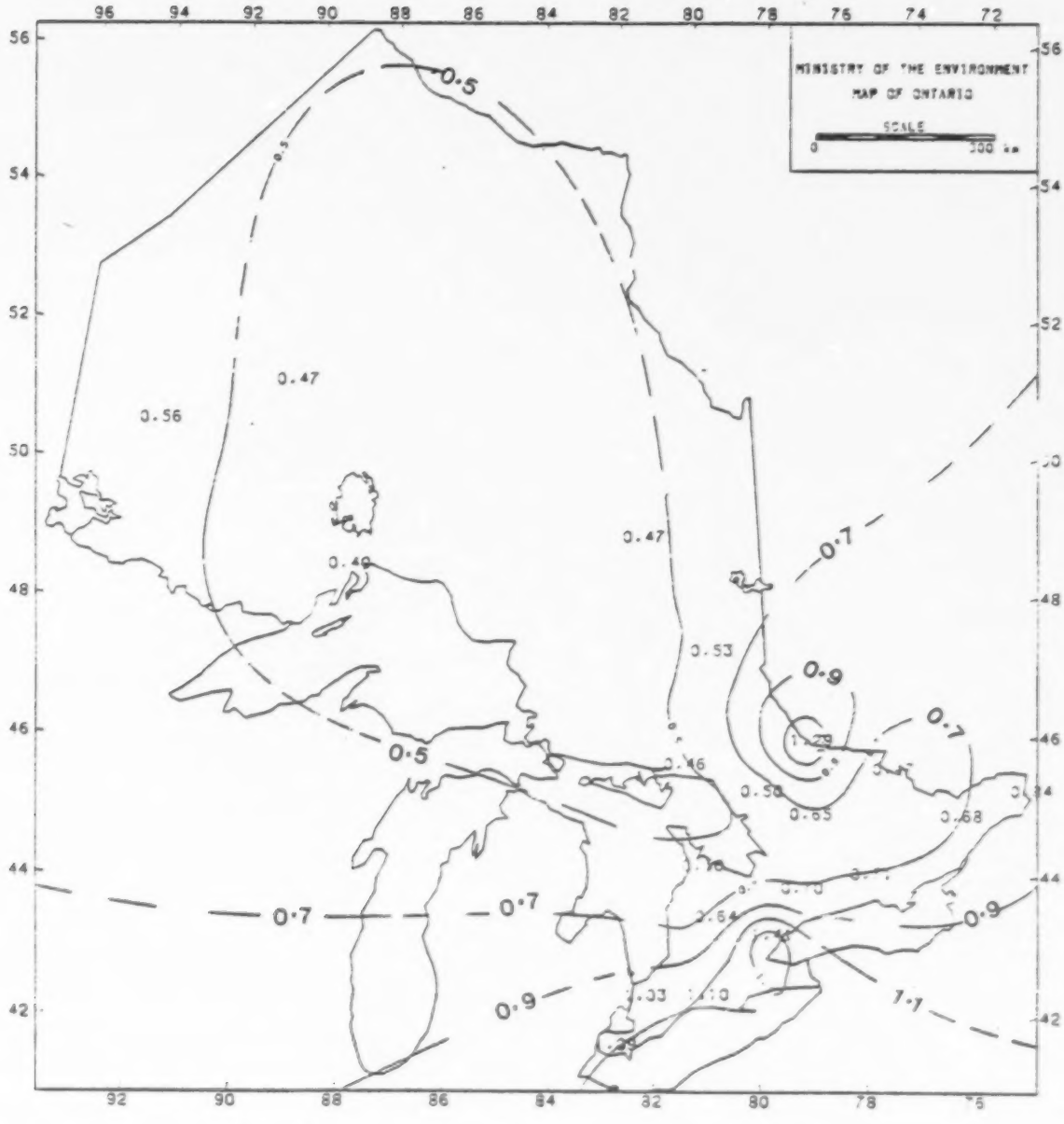


Figure 30. Annual average air concentration (10^{-1} ug/m^3) of Fe - 1983.

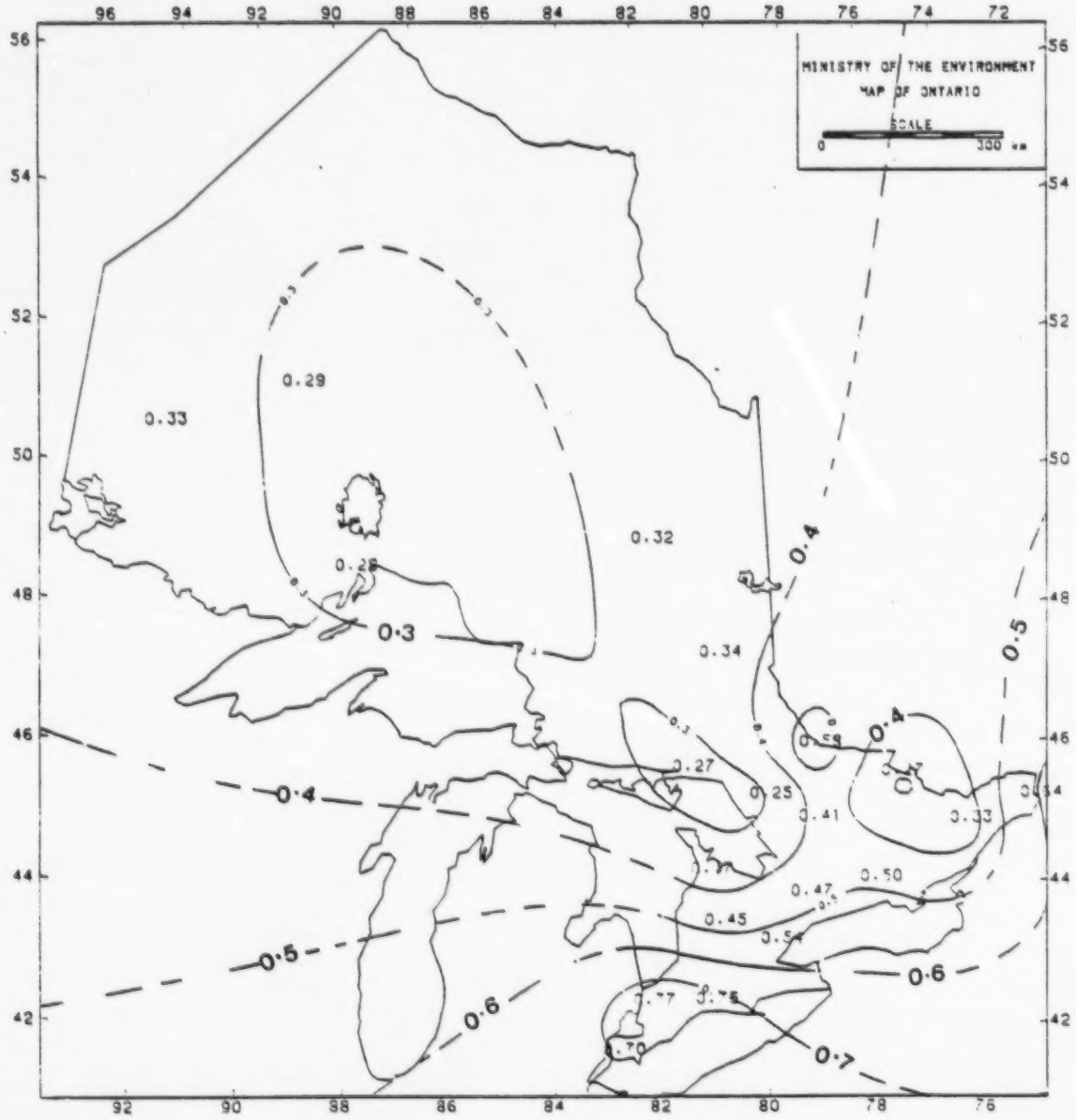


Figure 31. Annual average air concentration (10^{-1} ug/m^3) of Al - 1983.

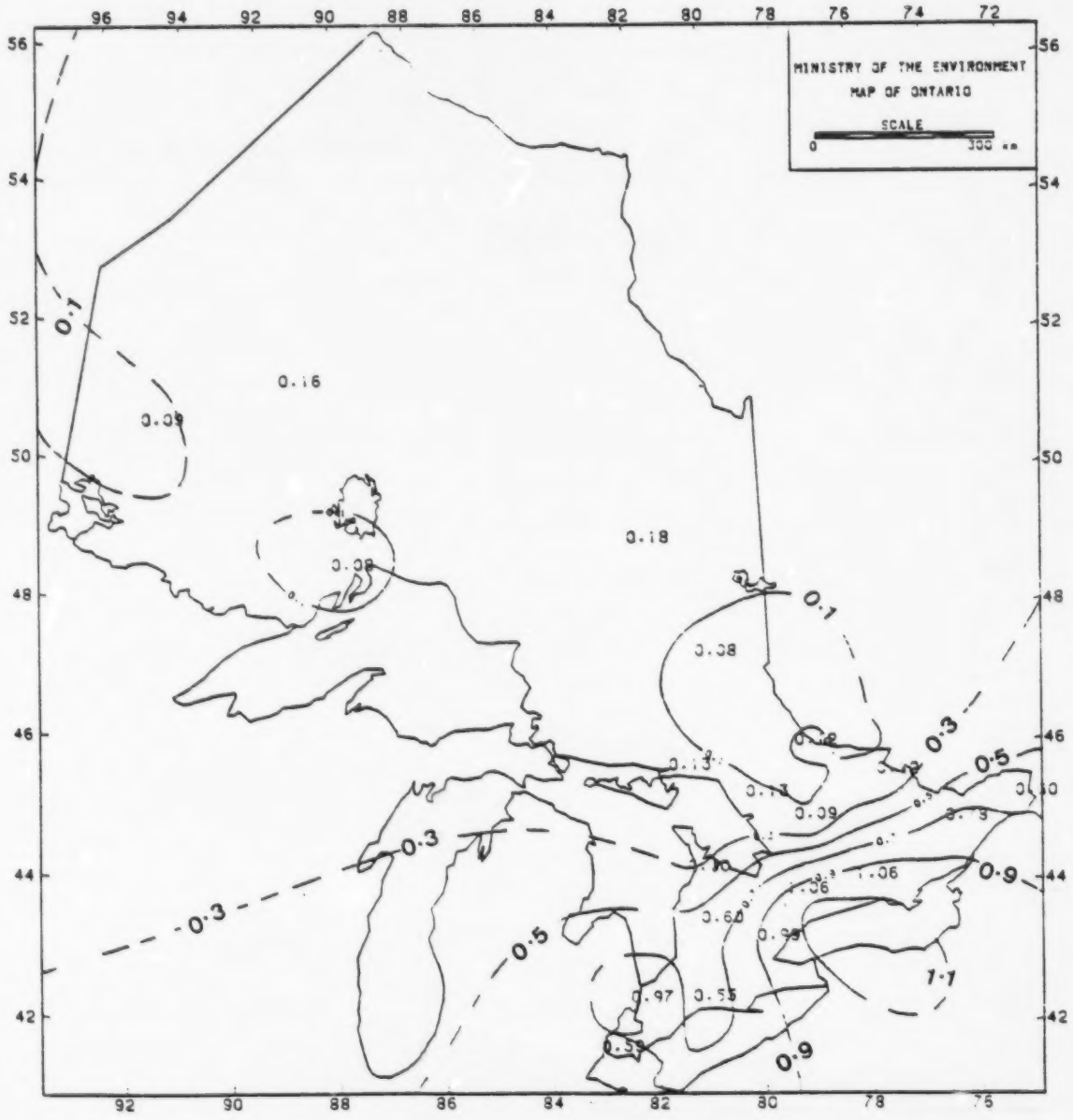


Figure 32. Annual average air concentration (ug/m^3) of Ca - 1983.

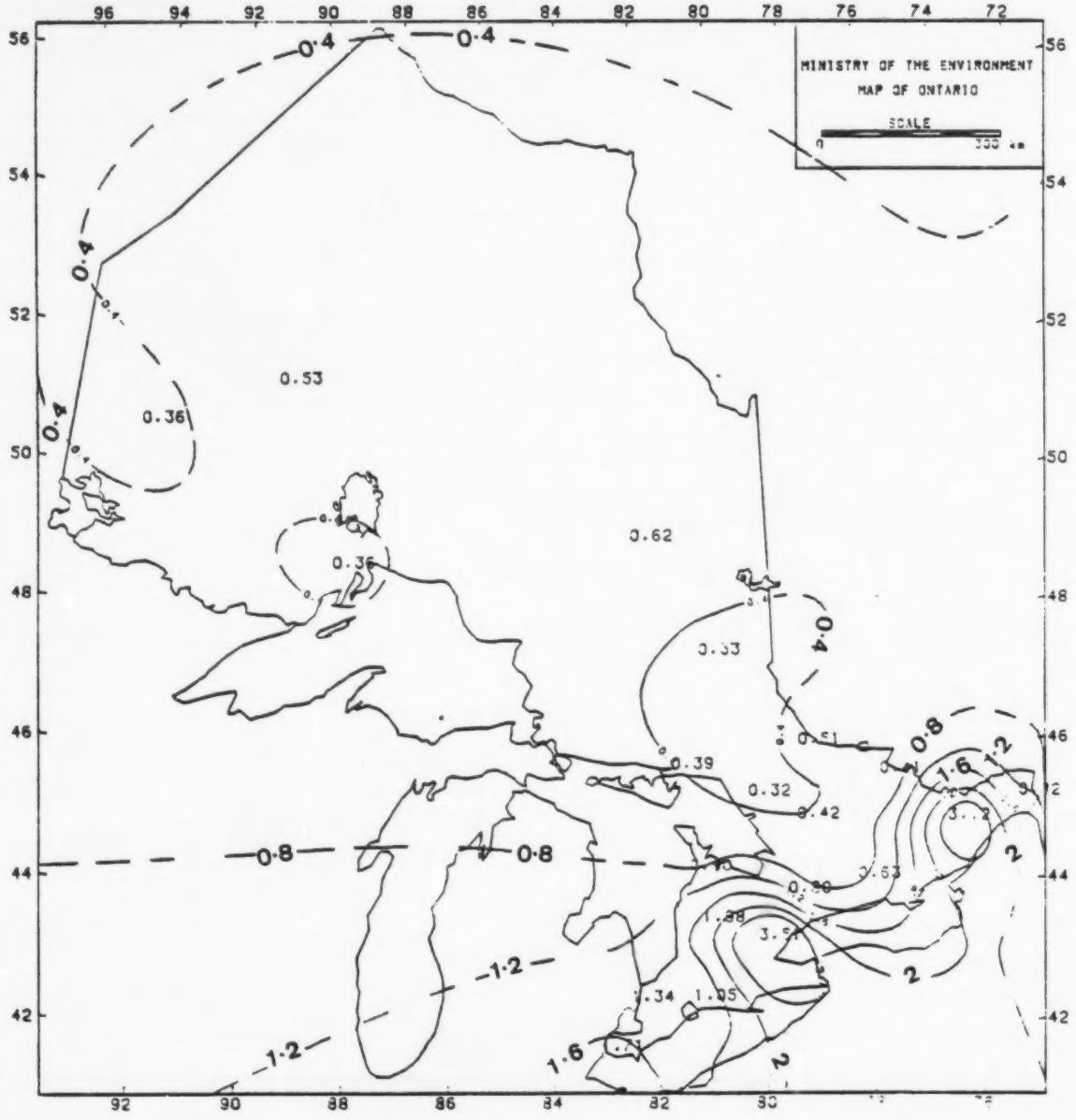


Figure 33. Annual average air concentration (10^{-1} ug/m^3) of Mg - 1983.

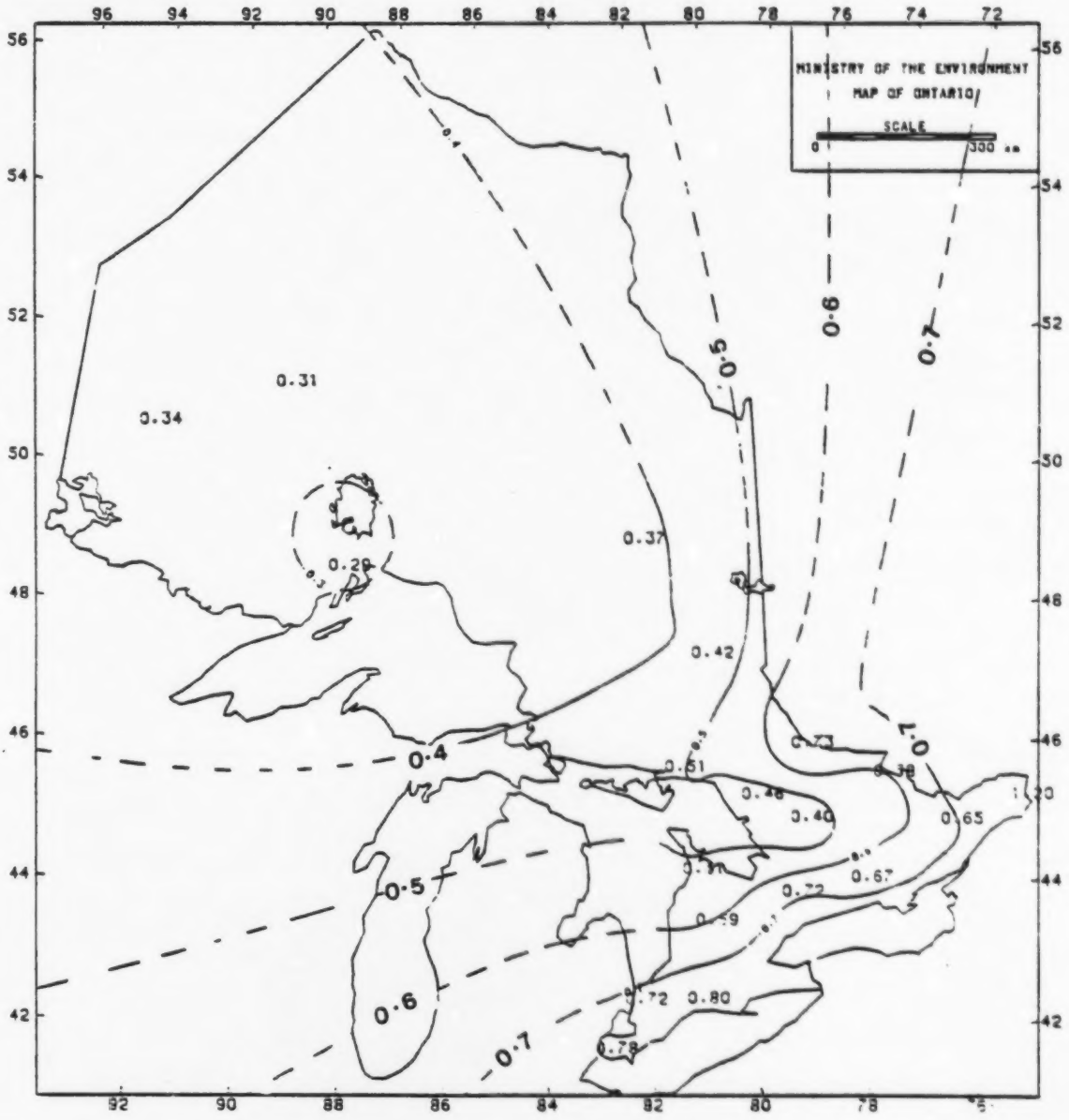


Figure 34. Annual average air concentration (10^{-1} ug/m^3) of K - 1983.

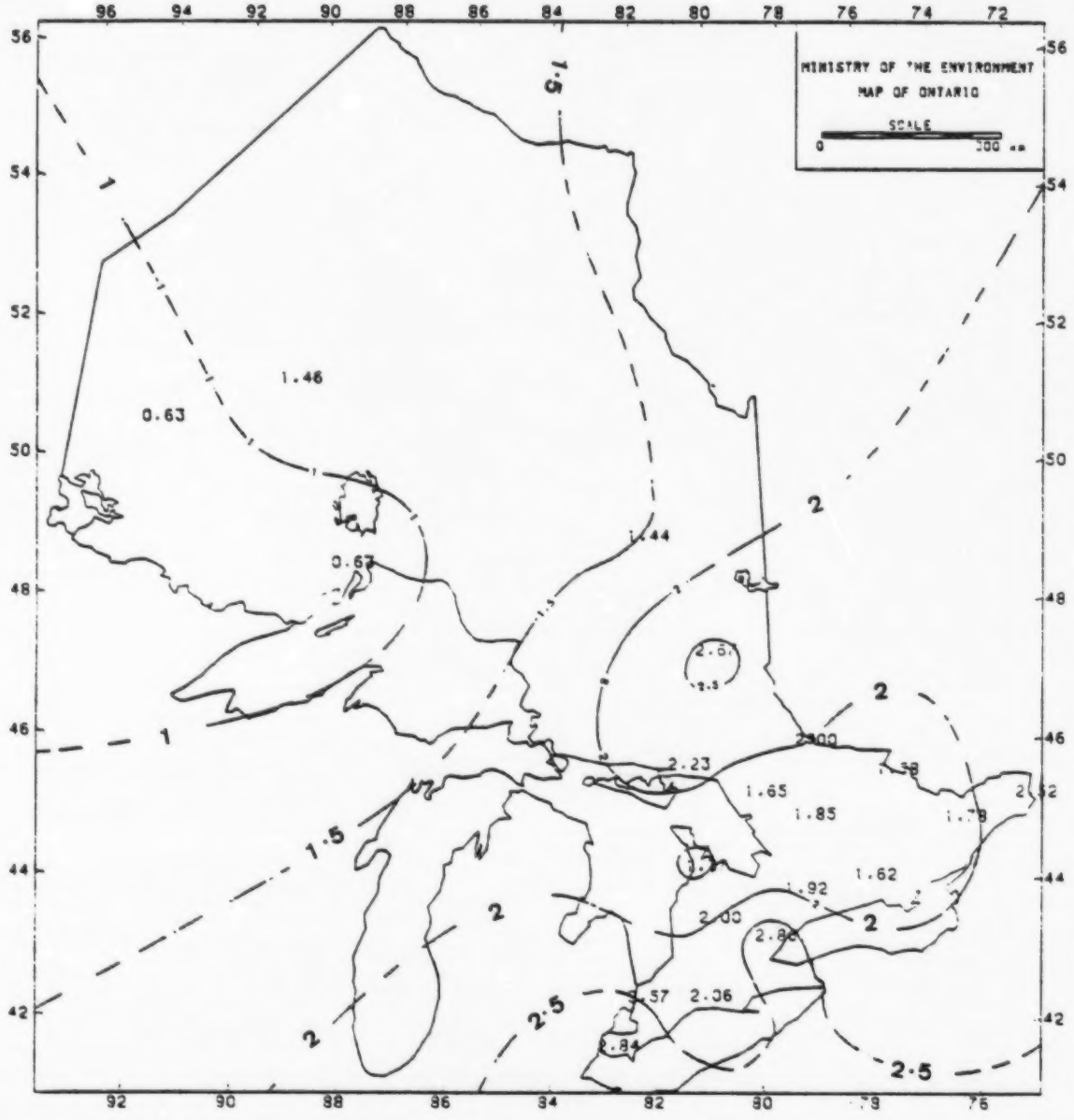


Figure 35. Annual average air concentration (ng/m^3) of Cu - 1983.

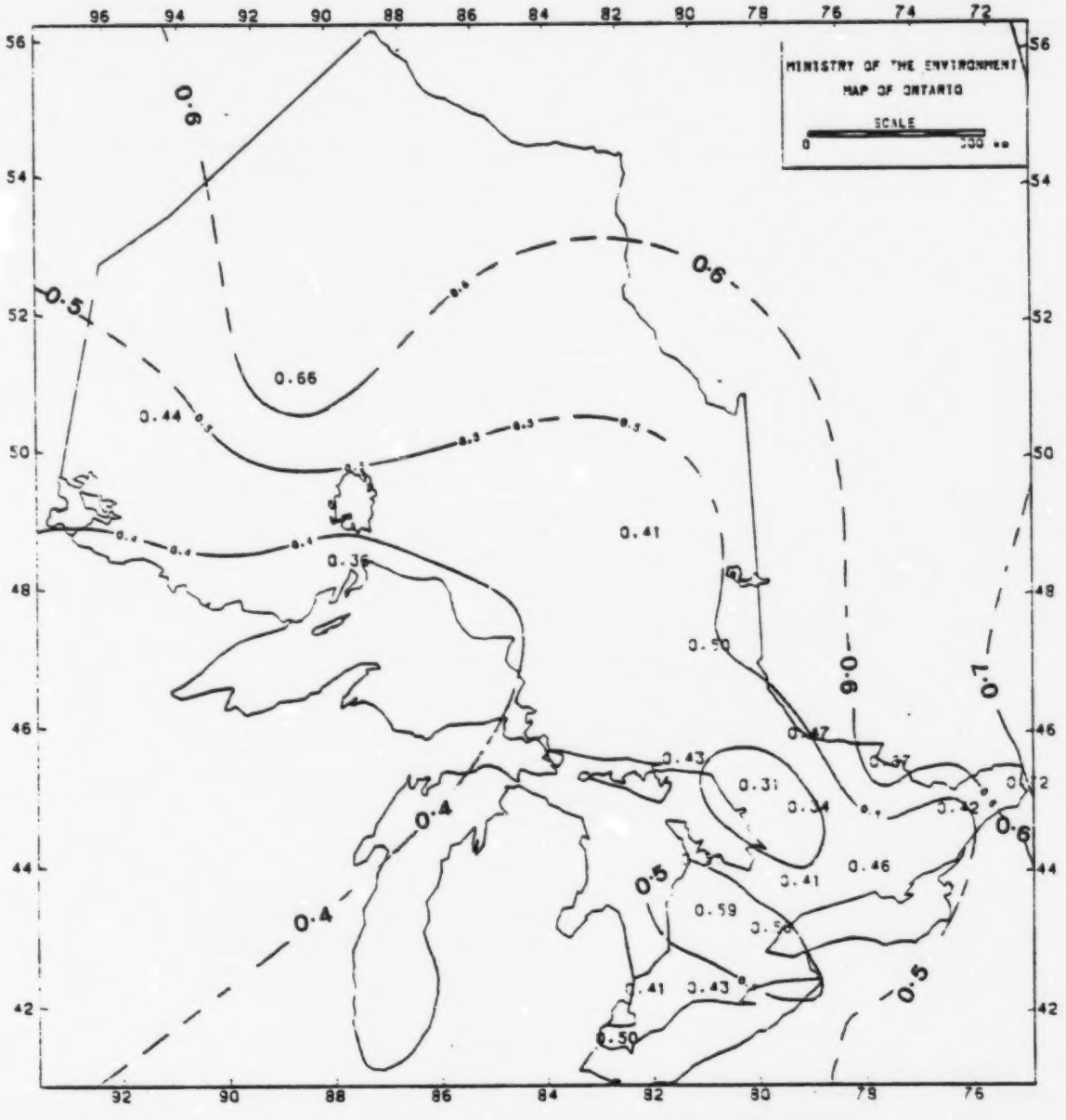


Figure 36. Annual average air concentration (ng/m^3) of Ni - 1983.

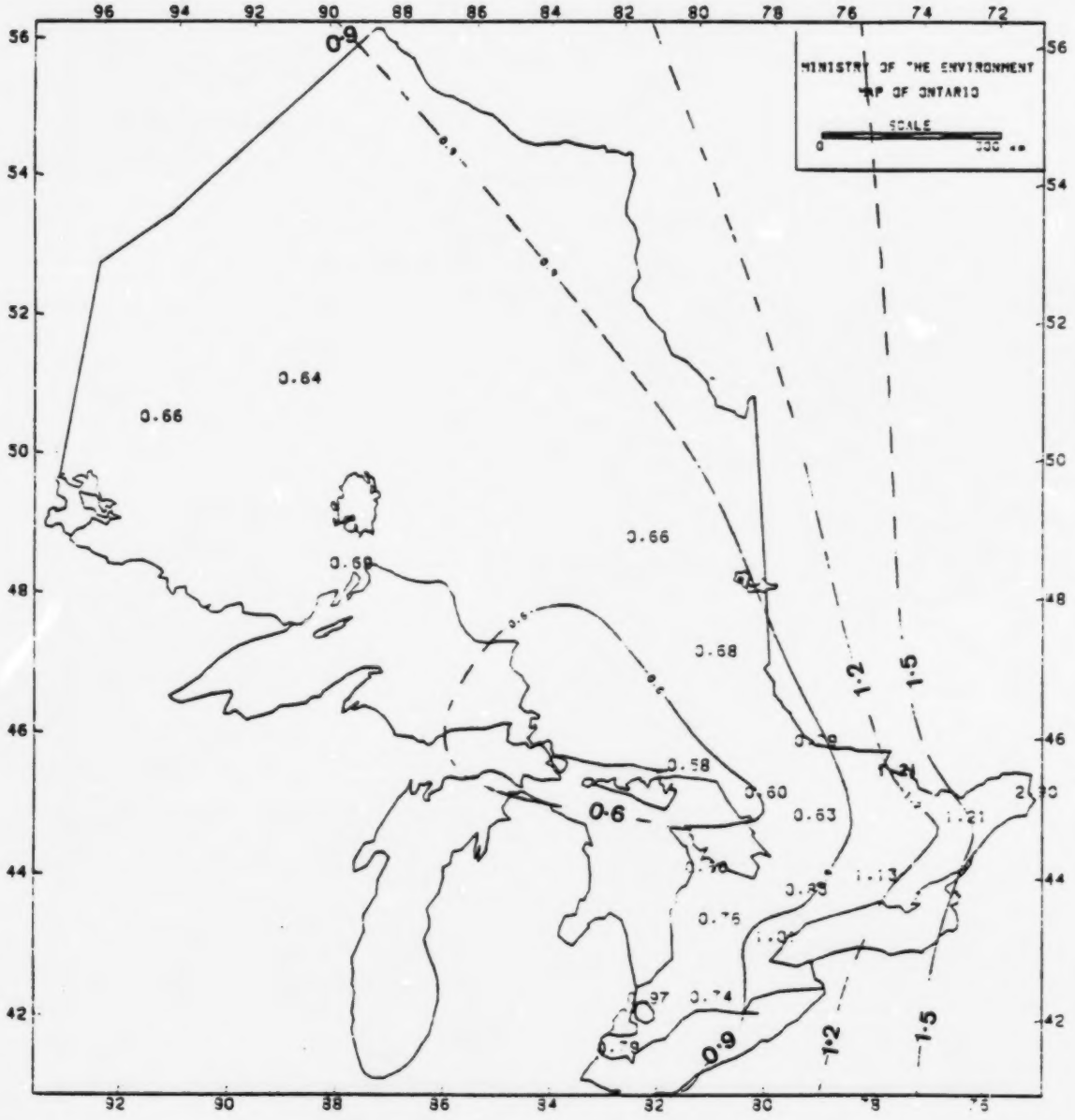


Figure 37. **Annual average air concentration (ng/m^3) of V - 1983.**

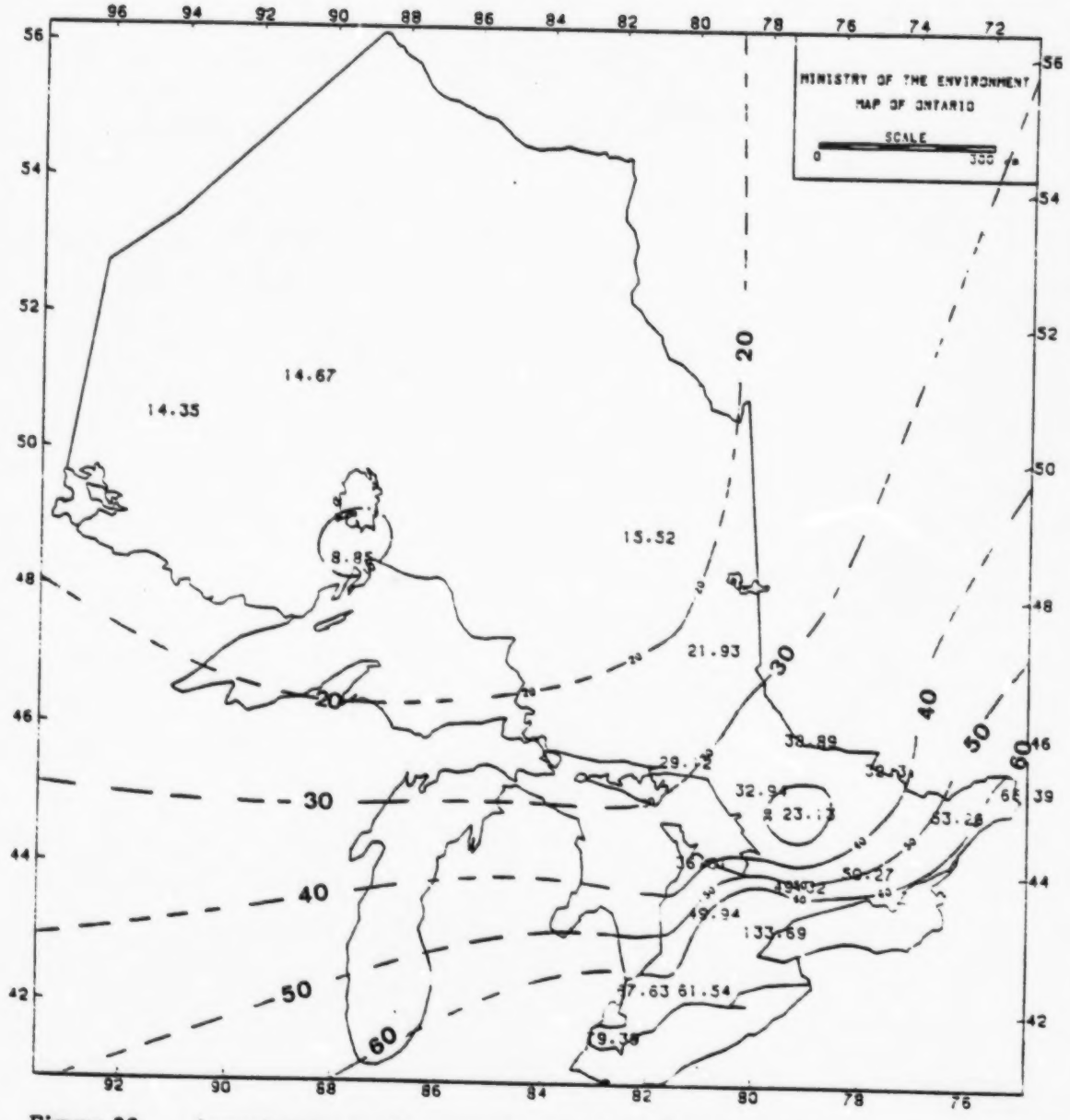


Figure 38. Annual average air concentration (ng/m^3) of Pb - 1983.

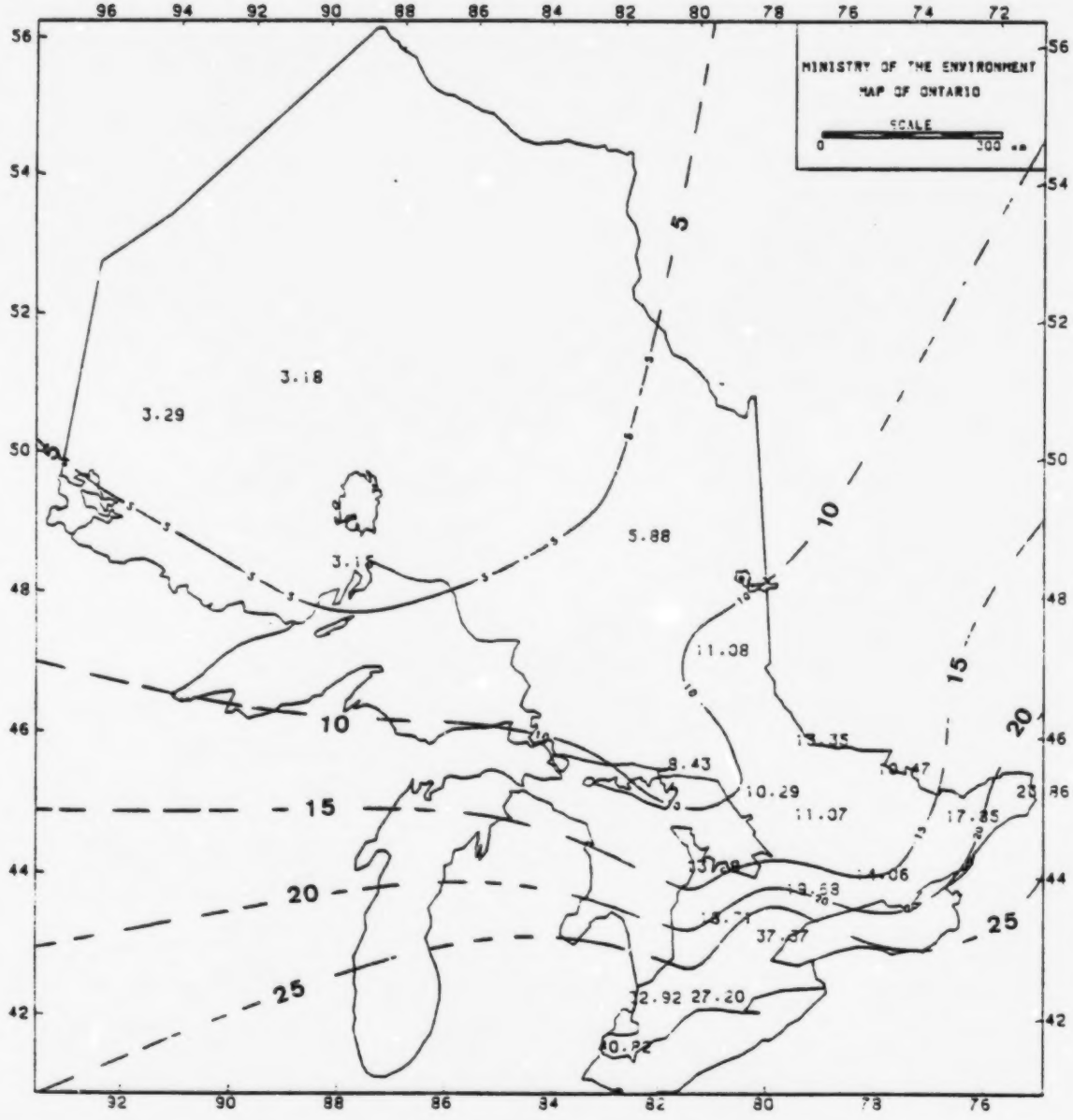


Figure 39. Annual average air concentration (ng/m^3) of Zn - 1983.

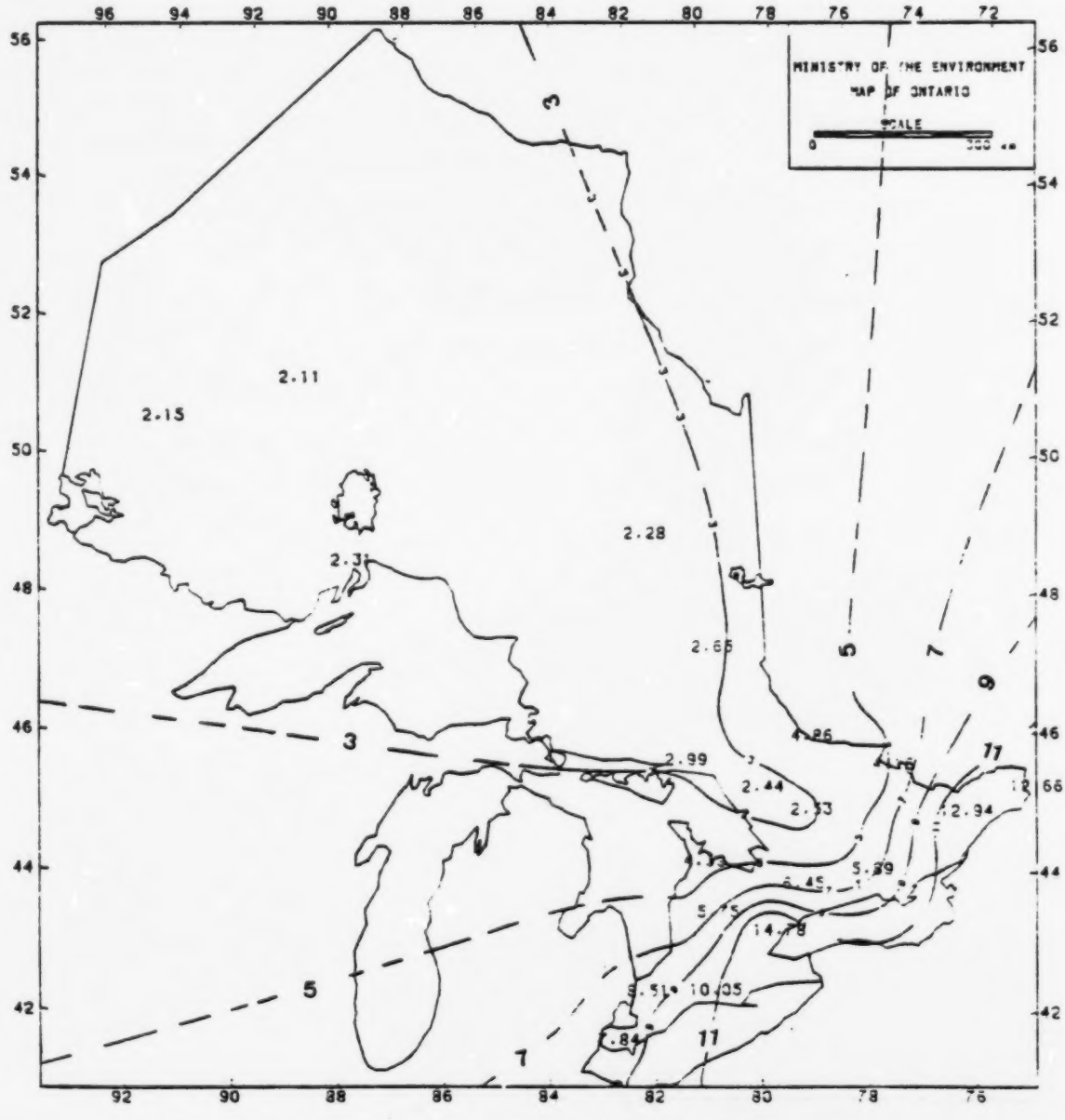


Figure 40. Annual average air concentration (mg/m^3) of Mn - 1983.

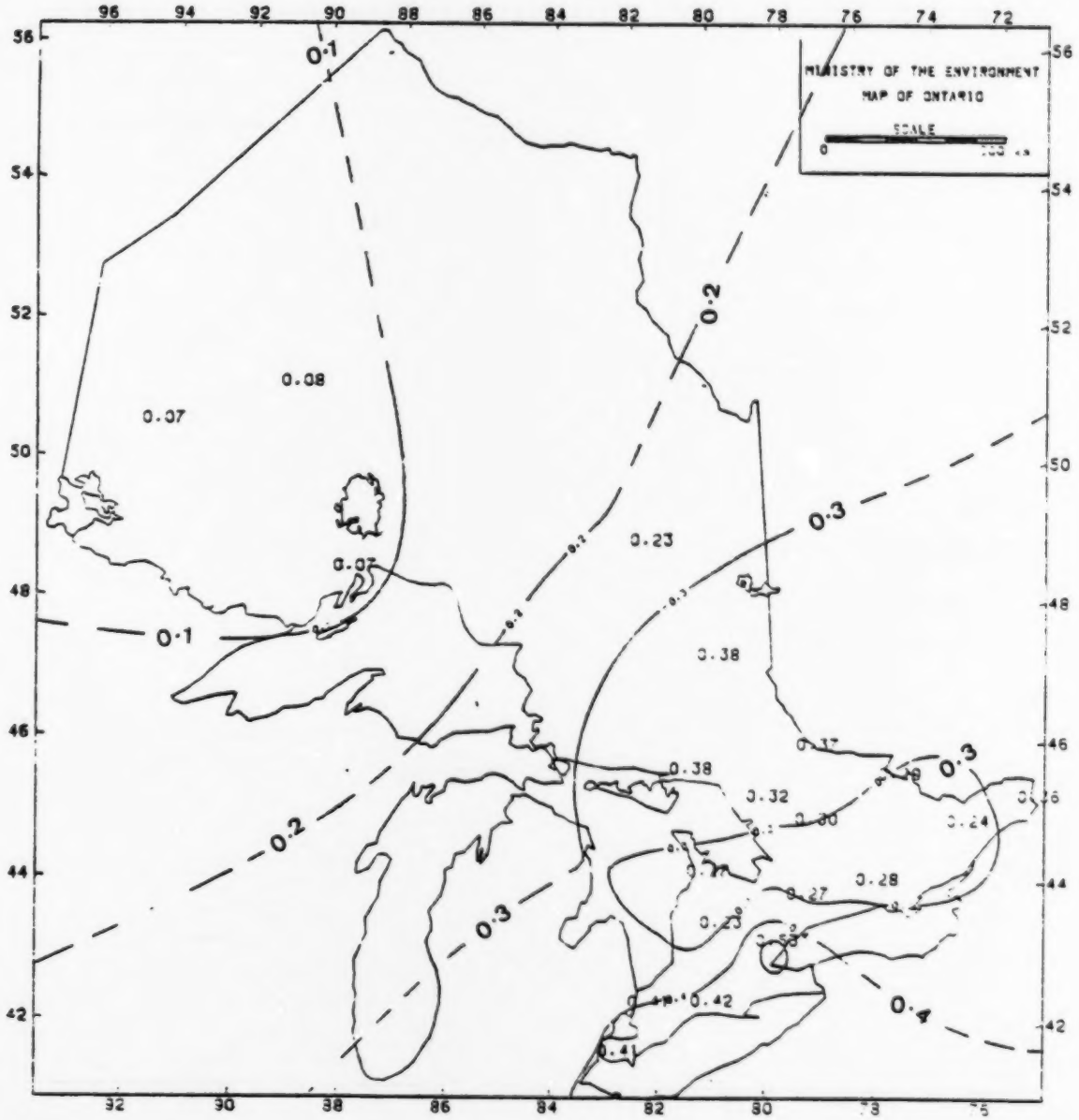


Figure 41. **Annual average air concentration (ng/m^3) of Cd - 1983.**

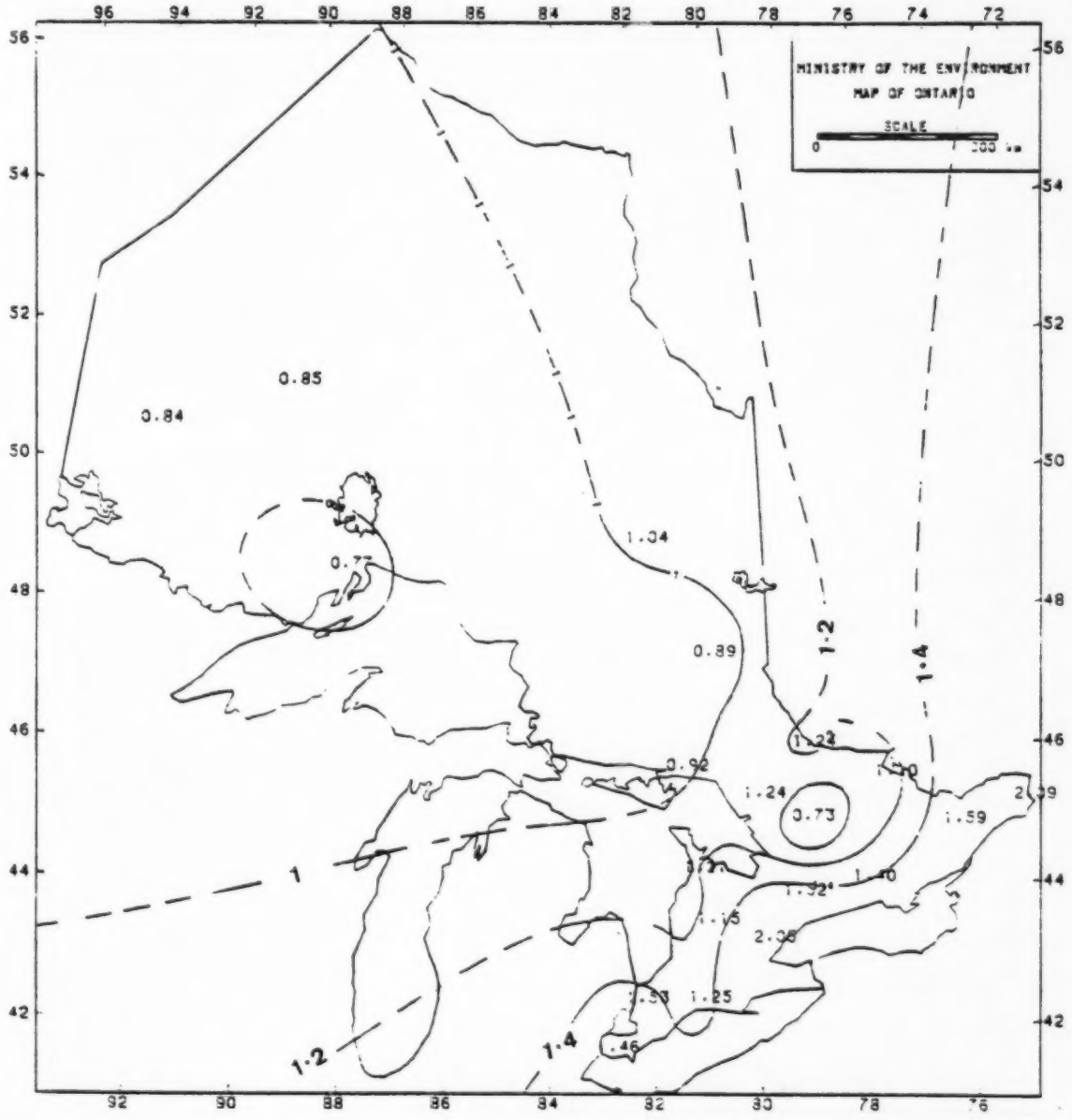


Figure 42. Annual average air concentration (10^{-1} ug/m^3) of Na - 1983.

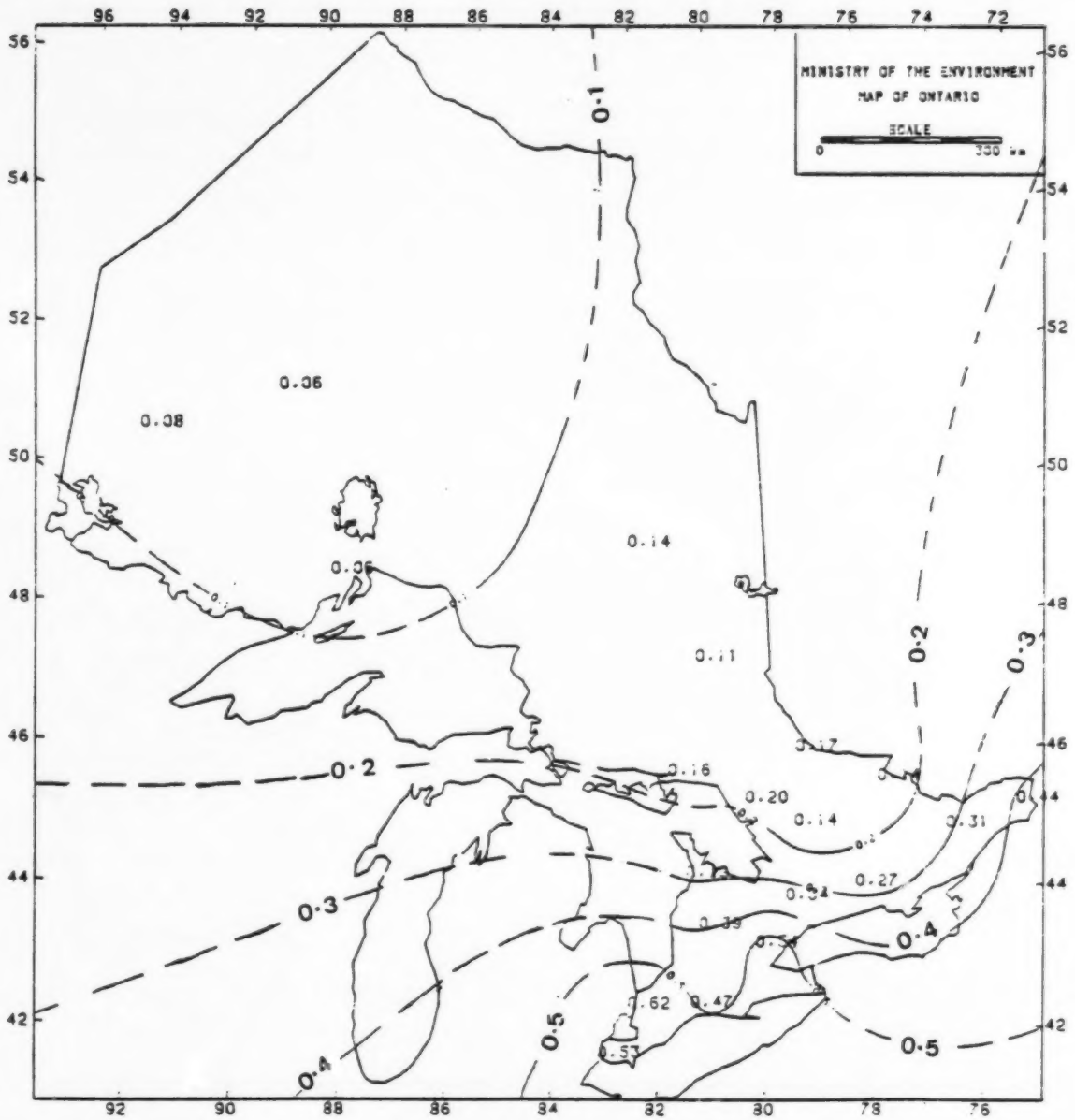


Figure 43. Annual average air concentration (ug/m^3) of Cl - 1983.

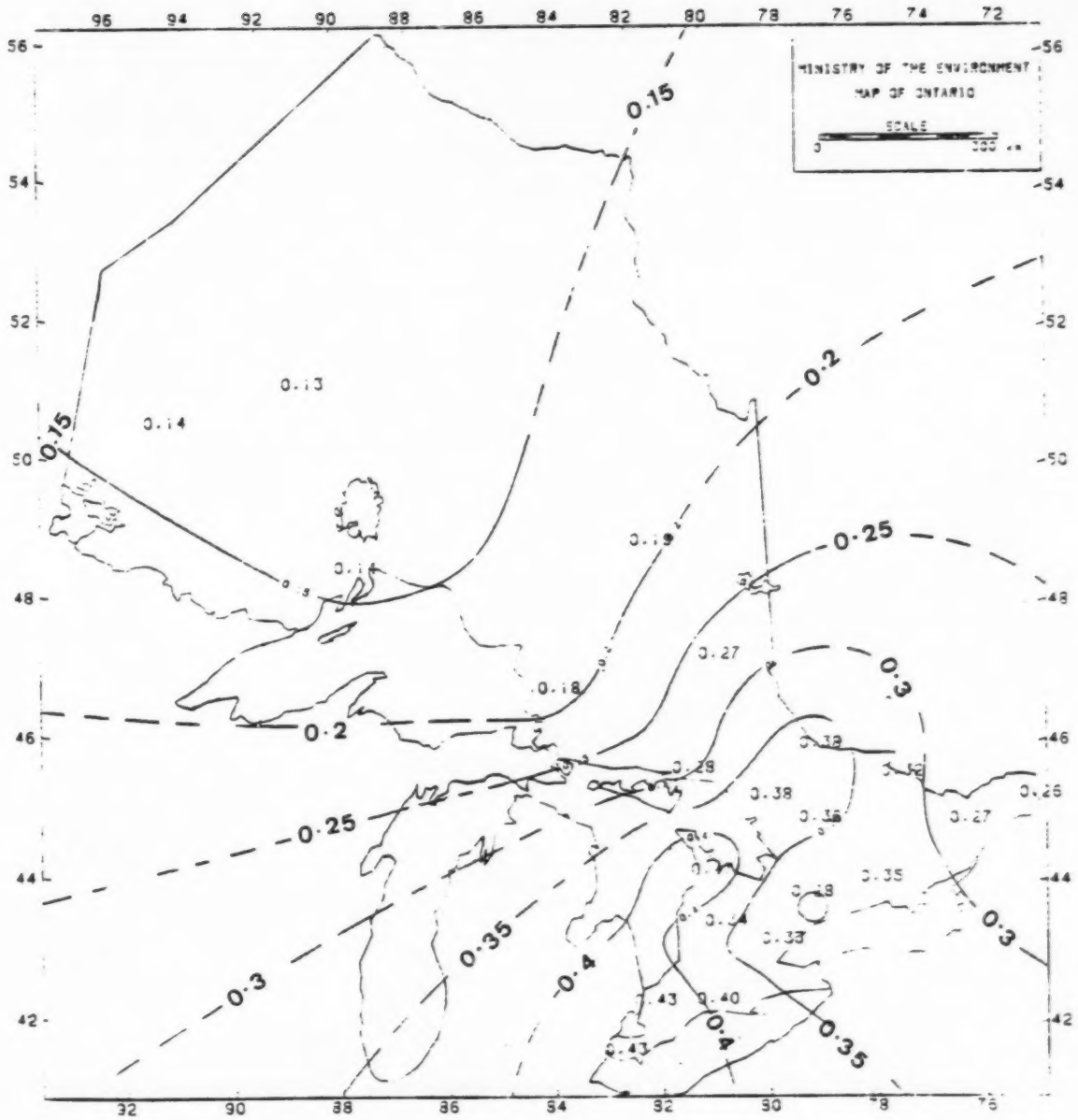


Figure 44. Annual dry deposition (g/m^2) of SO_4 - 1983.

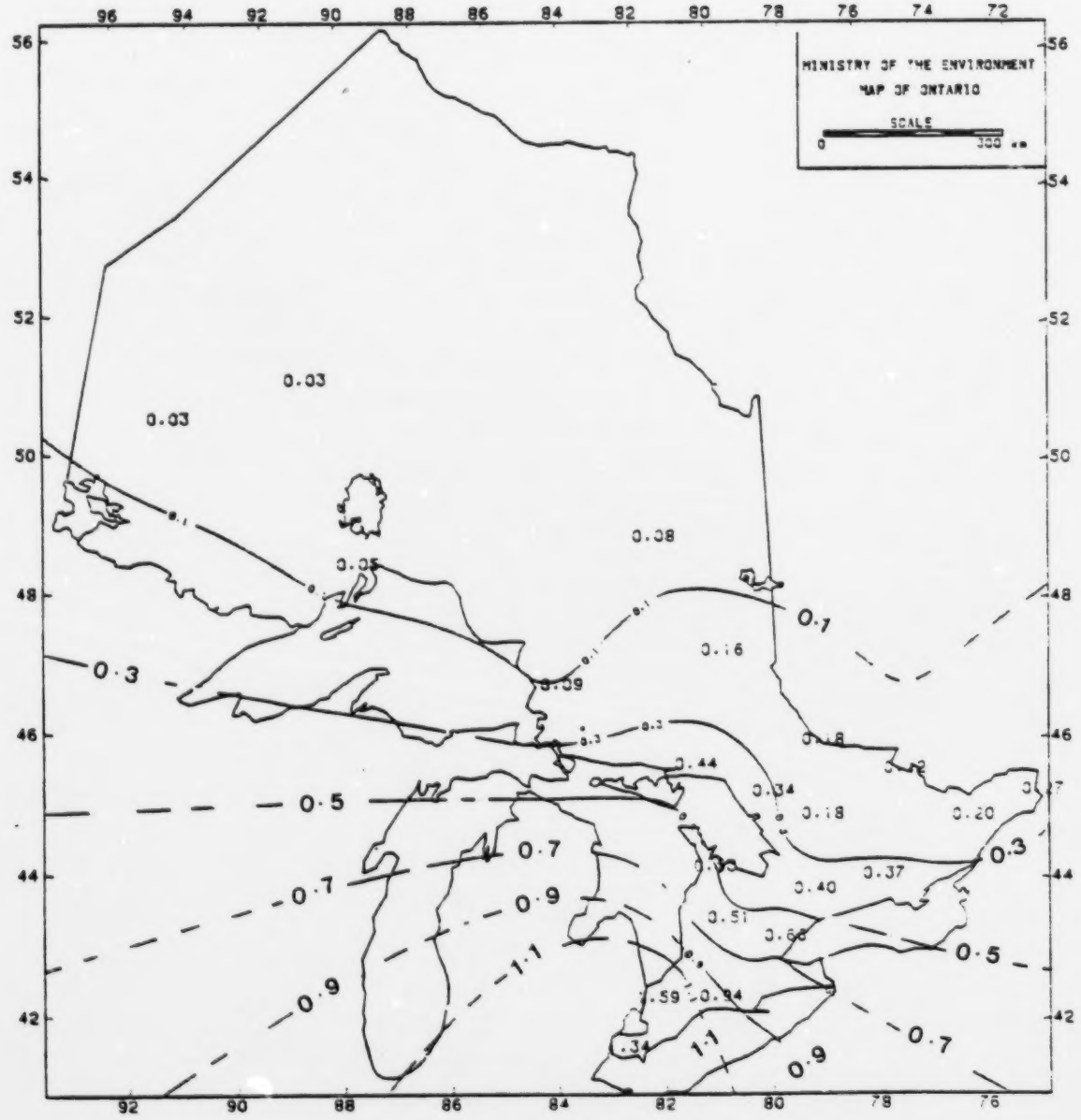


Figure 45. Annual dry deposition (g/m^2) of SO_2 - 1983.

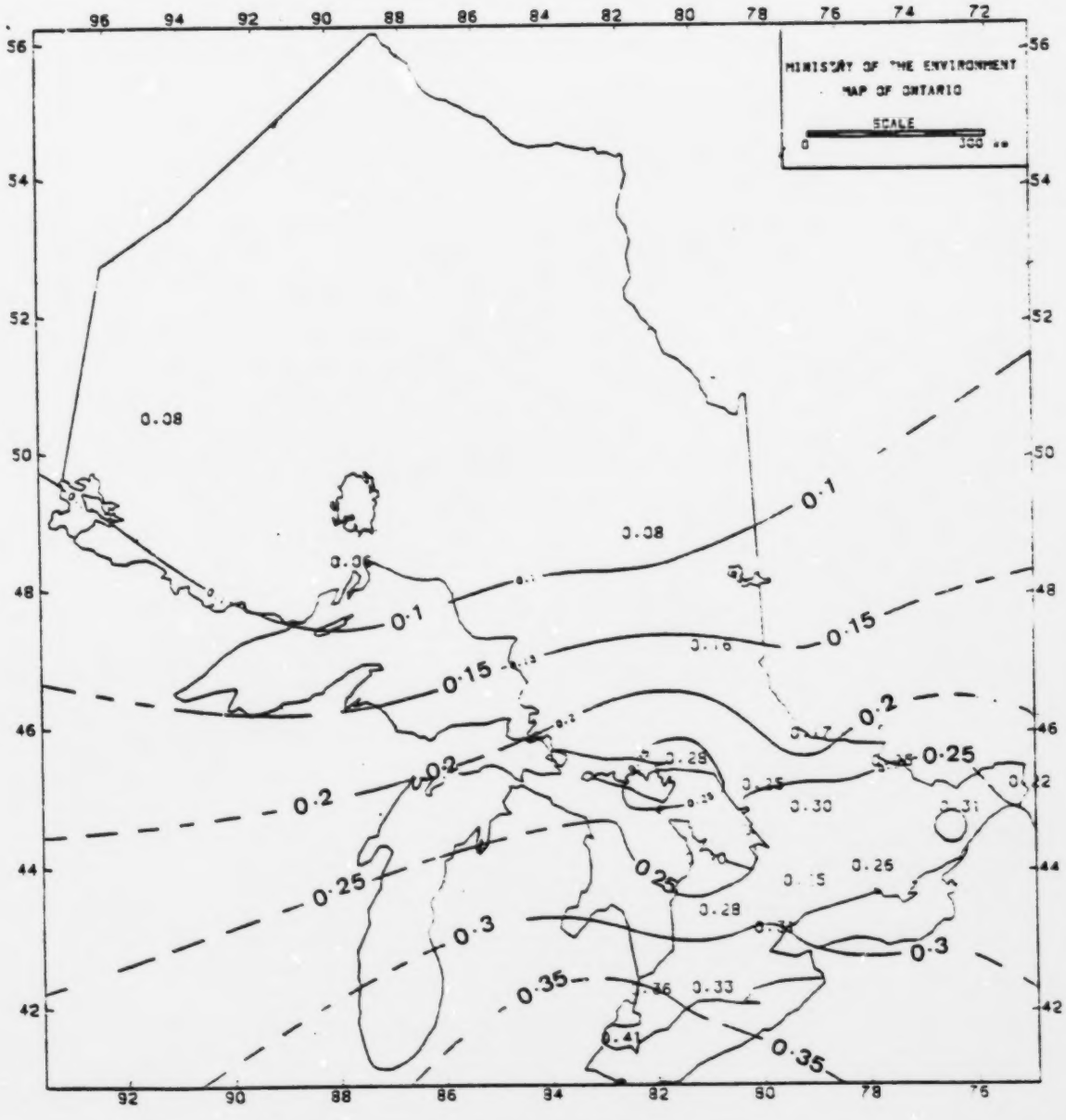


Figure 46. Annual dry deposition (g/m^2) of $N\text{-}NO_3$ - 1983.